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DECORATIVE WINDOW FRAMES IN CAST IRON.

BY HIRAM PRICE.

CAST IRON is not a material which we are accustomed to consider as suited for the window frames of buildings of any high architectural pretensions. For this use, regarded from the artistic point of view, it has thus far achieved anything but a favourable record. We chiefly associate cast-iron windows with such matter-of-fact structures as factories—structures in which ugliness rather than beauty would seem to be the result aimed at. We are also tolerably familiar with them in the rural districts as associated with cottages of the "model" order, and in which they have generally much about as cheering an effect as iron gratings have in a prison.

Nevertheless, it cannot be doubted that the capabilities of this material for this purpose are great. That such is the case has been recognised by able architects. Rickman, who some half a century ago earned the (not undisputed) title of "Restorer of Gothic Architecture," thought so, and tried hard to utilise it. It appeared to him that to shape in stone the intricate forms of Gothic tracery—which are often mere repetitions—was a slow, laborious, and wasteful process; and that it might be accomplished as well, and much more economically, in cast iron. In St. George's Church, Birmingham, he has placed on record an attempt to act on this conviction. Some of his cast-iron Gothic work there, as, for instance, the parapet of his tower or the applied ornament of his buttresses, is good enough to pass muster; but even this cannot be said of the tracery of his windows. The leading lines in them are by no means bad; carried out in stone, they would have looked well; but there is about them an attenuation which ruins their effect. The architect felt that it would have been absurd to have given to a strong material like iron the bulk demanded in stone, and thinned down his tracery accordingly; but he neglected at the same time to give to his work any of the distinctive characteristics of metal. The result therefore was a feeble caricature of stone tracery.

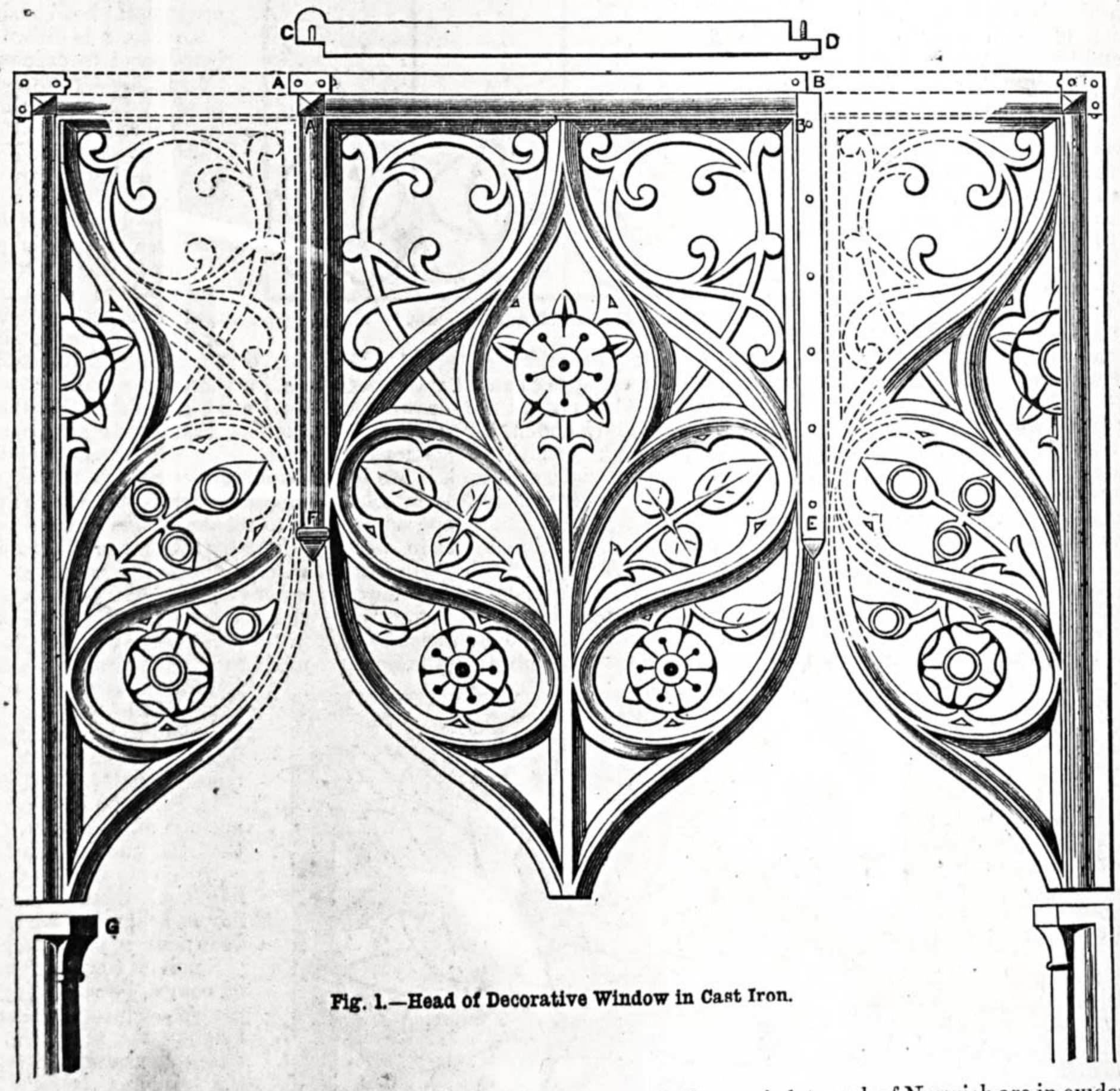

Fig. 1.—Head of Decorative Window in Cast Iron.

The teaching of this and similar failures is not that the material is necessarily unsuitable, but only that it must be used on sounder principles. Good rarely comes of trying to make any material pass for what it is not. Honesty is essential in æsthetics as well as in morals. A material will rarely look satisfactory if it does not by its treatment frankly declare what it is. Our metal frames, to be truly artistic, must plainly say that they are metal, and nothing else.

I believe in cast iron for decorative window frames because I know of no other material in which so rich an effect is to be obtained, combined with equal strength, and at as low a cost. Mr. Ruskin has, indeed, said something to the effect that it is impossible to produce anything artistically good in cast iron; but with all due deference to Mr. Ruskin, I must be allowed to differ with him on this point, when I reflect that the old work of Sussex and the modern work of Norwich are in evidence against him.

Although in the designs now laid before the reader the lines of flamboyant Gothic have to some extent been followed, I must disclaim any attempt to give distinctly Gothic windows suited for Gothic buildings only. The flamboyant lines are merely used because they seem best to bring out the capabilities of the material. The patterns given are intended to fill ordinary square-headed windows. It should also be observed of these

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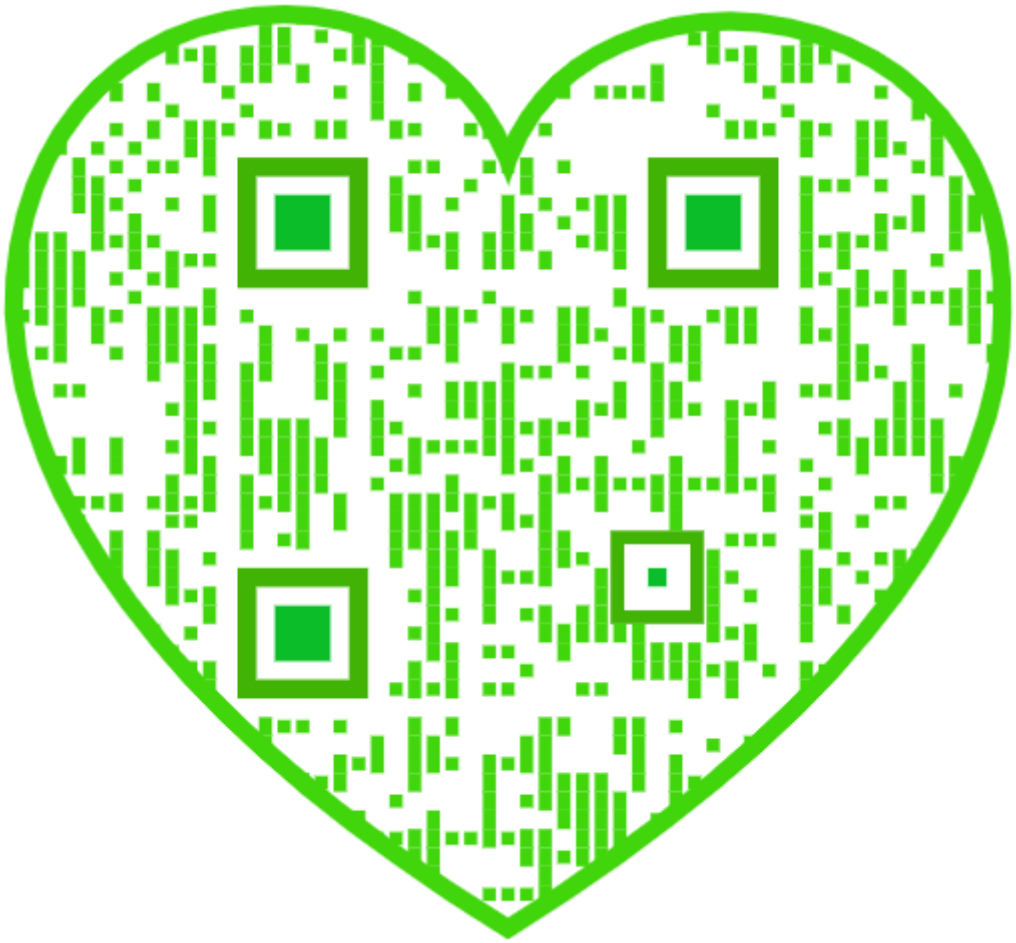

designs that castings from them will be in no danger of being mistaken for stone or anything else than what they are: and this point it is proposed should be still further emphasised in painting them, such colours only being used as we are accustomed to associate with iron-work.

I offer these designs to those interested in building as so many suggestions merely, to be taken for what they are worth. For, though the writer of this paper may not be absolutely without experience as a modeller of ornamental iron casting, he makes no claim to be considered a practical pattern-maker; and he does not question but that a practical man, setting himself to carry out one of these designs, will be able to introduce various technical improvements in it. Nevertheless, he has a confident hope that as suggestions his designs may prove of value.

As it is proposed to cast the ornamental parts in panels, the designs, with the addition of plain bars to form mullions and transoms, can be combined so as to form windows of almost any size or shape; and with the various designs are given hints for screwing together the different portions of a frame in such a manner as not to be unsightly. By these arrangements, and by the use of iron-glue at the joints, the whole frame may be made as rigid as if cast in a single piece.

A glance at one of the more important illustrations (say Fig. 1) will show that the ornamental work is of two kinds—the thicker members which follow somewhat Gothic lines and which carry the glass, and the flatter intermediate work, against which the glass simply lies. The illustrations are not drawn to any exact scale, but supposing the repeating panel in Fig. 1 to be a foot across, those members of the design which carry the glass would measure about three-quarters of an inch from side to side and from front to back. Something of the general section of these members may be seen in Fig. 6; and on each side of them is a rebate on which the glazing is done in the ordinary way with putty. The glazing is supposed to be on the *inner* side of the window.

The intermediate work is supposed to be cast quite flat on its inner side, and it might have a general thickness of about a quarter of an inch. On its outer side it would be slightly relieved by either raising or incising the fibres of leaves and similar markings: emphasis would afterwards be given to such markings by paint or gold.

An alternative treatment of this intermediate work might, however, be found in piercing it, as indicated in the leaves and flowers of the side panels in Fig. 1, and inserting small discs or other pieces of coloured glass. The small section (Fig. 7) shows how, in case this latter arrangement should be followed, a little rebate is formed in the flat surface of the intermediate work to receive the coloured piece. For this scarcely any putty would be needed, as the coloured disc would be kept in place by the large pane of glass against which it would be pressed.

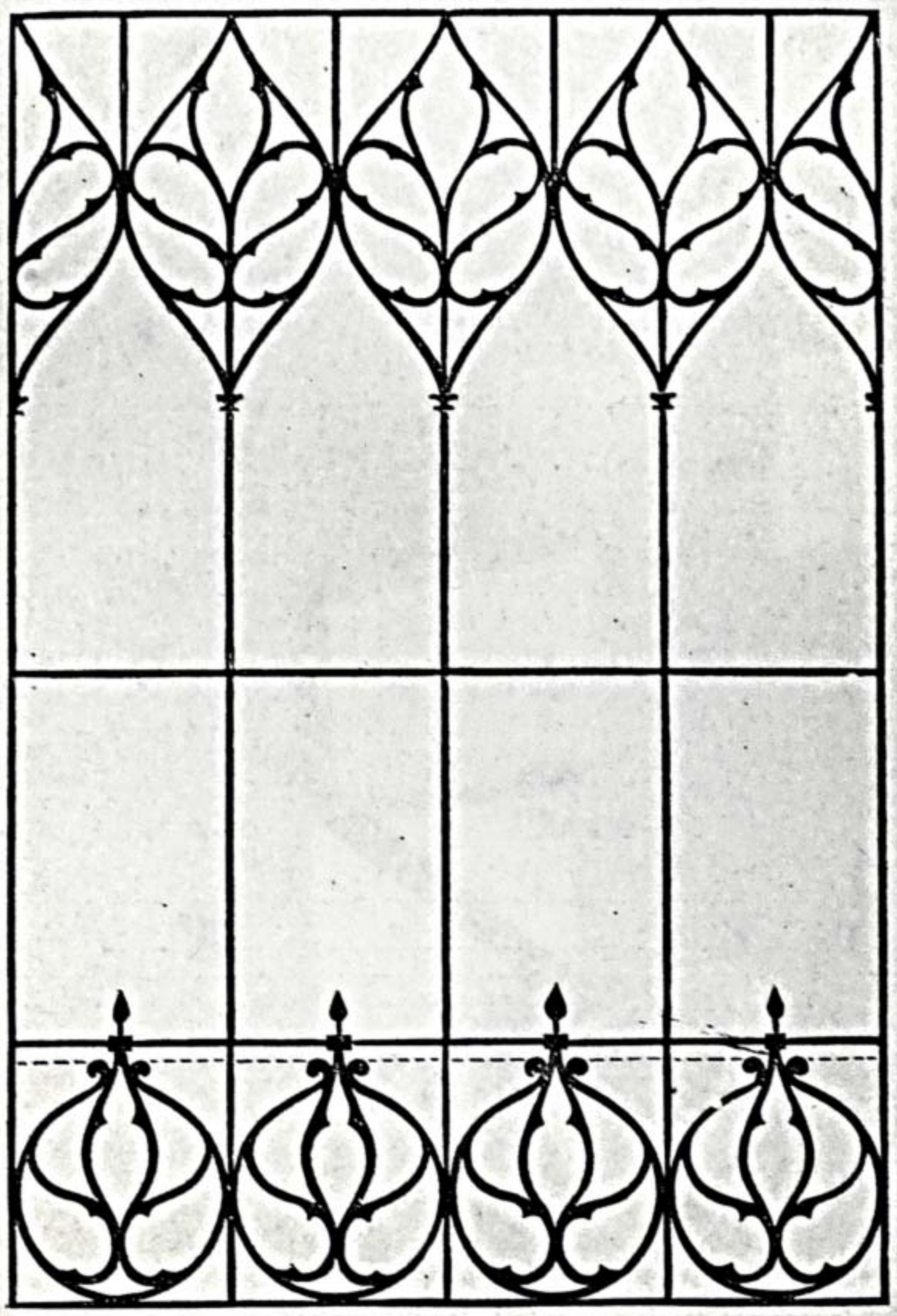

Fig. 3.—Skeleton Plan of Window.

But to speak particularly of Fig. 1. We have in this a repeating panel for the head of a window. At its sides are drawn two half-repeats, to show something of its effect when in position; but those portions of these half-repeats which approach it are left merely dotted, that they may less interfere with the actual panel. The supposed size of this panel is 12 in. wide by 21 in. deep, but it would in no way suffer by being cast on a somewhat larger scale. The flowers and leaves are shown in this as being "cut up" on their outer surface by incisions in the flowers and by raised fibres on the leaves, to be picked out in painting with black or gold. But in the half-panels at the sides is indicated, as we have already seen, the alternative method with coloured glass. As seen from the outside of the window, the "cutting-up" method will be most effective; but the coloured glass will give greater variety as seen from within.

It will be observed that at C D, Fig. 1, is given a section at the top of the panel on the line A B, showing how each repeat of this panel is made to overlap its next neighbour, and is attached to it by screws from behind. By "behind" we should perhaps explain that the inner side is meant, these diagrams in a general way representing the *outer* side of the window. From B to E are shown the screw-holes in the back portion, and from A to F the rounded front moulding into which the screws are driven. At G appears the capital of one of those mullions on which such an ornamental head is supposed to rest.

In Fig. 2 is drawn an ornamental base panel to accompany the head in Fig. 1. Of course it will not be in every instance that such a base will be required. If an unimpeded view is desired, or if it is necessary that the lower part of the window should admit as much light as possible, no base panel will be used. If, however, a certain amount of obscurity is wished for—indeed, in all cases where it is usual to insert ground glass, or to use wire-blinds, or anything of a similar nature—the base panel will come in admirably; and, artistically speaking, render the window most complete. In the mere skeleton sketch (Fig. 3) is shown a window with these ornamental panels at base as well as head. At H and I, Fig. 2, may be seen a method of fixing the base panel by screwing it to rebates in the upright mullions.

The bottom bar of the frame at K, Fig. 2, will of course be moulded sloping on its outer side to throw off rain, and the bases of the mullions L and M will probably be cast in the same piece with it, the mullions being made to fit into them with mortice and tenon joints. L is a corner base, and as there will be a necessity for keeping it square to fit the angle of the brickwork, it is shown as finished with merely a nail-headed ornament.

In Fig. 4 we have an intersection of mullion and transom. It is proposed that the ends of the latter should fit with tenons into mortices in the mullion, and there be fixed. The small flower ornament at the intersection, shown at N, is attached by a screw through its centre. The transoms can, of course, be so arranged as to divide the space into panes of any desired height. Fig. 5 illustrates a method of fixing the head panels to the caps of the mullions by screws, which will be concealed by the putty used in glazing. Fig. 6 is a general section of the glass-carrying members. Fig. 7, to which allusion has already been made, is a section in a leaf or flower of the intermediate flat work, and will give some idea of the method proposed for fixing in small pieces of coloured glass by means of shallow rebates.

The above suggestions for fixing the

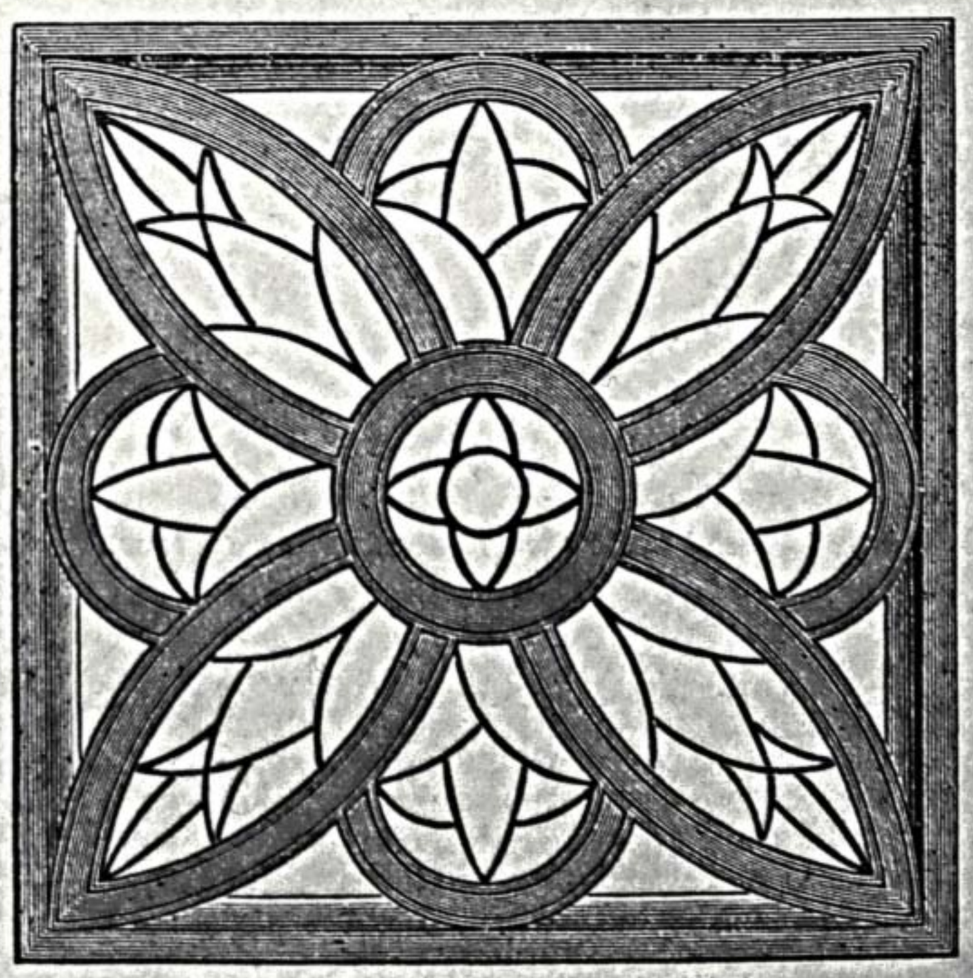

Fig. 9.—Iron Frame with Lead Glazing.

Fig. 11.—Plan, showing Mode of joining Square Forms.

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different parts together will sufficiently demonstrate that these designs are practicable, and from them any amateur who may choose to make his own patterns for casting will be able to work. The professed founder, however, if he takes this work in hand, will doubtless modify them to a certain extent, so as to make them conform to the ordinary rules of his own practice.

By combining the above-described decorative panels and plain minor parts, it will be seen that windows much varied in form and size may be produced. And they may be produced at little cost, for as the parts repeat the expense of making very few different patterns need be incurred. Where the windows are of considerable size, let us say of half a dozen repeats or upwards of the head panel, a better effect will be attained by breaking the work at intervals with thicker mullions, and thus forming separate lights of two, three, or four repeats each; and to give to each light its best effect, it should have a *central* panel in its head—let it have, say, one repeat and two halves, or three repeats and two halves. These designs, it should be borne in mind, are not suited to flat windows only: they will have an exceedingly good effect if introduced in the projecting windows so frequent in the Elizabethan style; only special angle-pieces will then be required.

The panel shown in Fig. 8 is one which may be either extended over a whole window or used in connection with plain panes. In a window which is wanted to admit a certain amount of light, but not to be looked through, these panels would be placed resting on one another from bottom to top, and would have the effect of rich lattice-work. In a lighter window, one to be looked through, the panels might be disposed in horizontal bands, alternating with plain panes divided by mullion bars. A window of moderate height would look well with three rows of panels—namely, at top, middle, and bottom.

These panels are shown as fixed to each other by screwing upon them, where the glass-carrying lines come in contact, small bands, like that at *o*, Fig. 8. If the entire window is filled with them, the tops of one row would be in a similar manner fixed to the bottoms of the row above it by a series of small crowns screwed on, like that at *p*. The flowers also, at Q, Q, are connections, being screwed on to half discs of metal in the panels, such as are shown at R, R. When mullion bars are made to alternate with the panels, the connection between panel and mullion would be as shown at S. The dotted portion above the line T U gives a suggestion for finishing the top of the window, but this might be done more simply by ending instead with a straight bar at that line, and screwing to it and the panels the alternate flowers and crowns.

Fig. 9 is intended to illustrate the combination of lead glazing with our ornamental iron frames; taken with Figs. 10 and 11, it will also show a method of joining square panels together. No overlapping edge is necessary, they being united by screws through their rebate projections, whilst to cover the joint an iron moulding with a tongue is inserted between; this shows in section in Fig. 10, and in plan in Fig. 11. Either plain white glass geometrically arranged or coloured glass might be used to fill the spaces in this design; if the latter, some sort of kaleidoscopic disposition of the coloured glass would tell best. The leaded work would, of course, be first soldered together, and then puttied into the iron frame. For this, somewhat wider rebates would be desirable than for glazing without lead. With the omission of the intermediate flat ornament, the designs Figs. 1, 2, and 8 might also be made to serve for leaded work.

Some reference has already been made to the manner in which these window frames should be painted. The colouring of them ought, as I think, to be looked upon as a matter of some importance. It should not be of such a character as can in any way cause them to be confounded with stone or wood. Such colours as we are accustomed to associate with decorative ironwork should rather be chosen. It will be with the outside of our windows that we shall chiefly have to deal, for the predominant colour of the inner

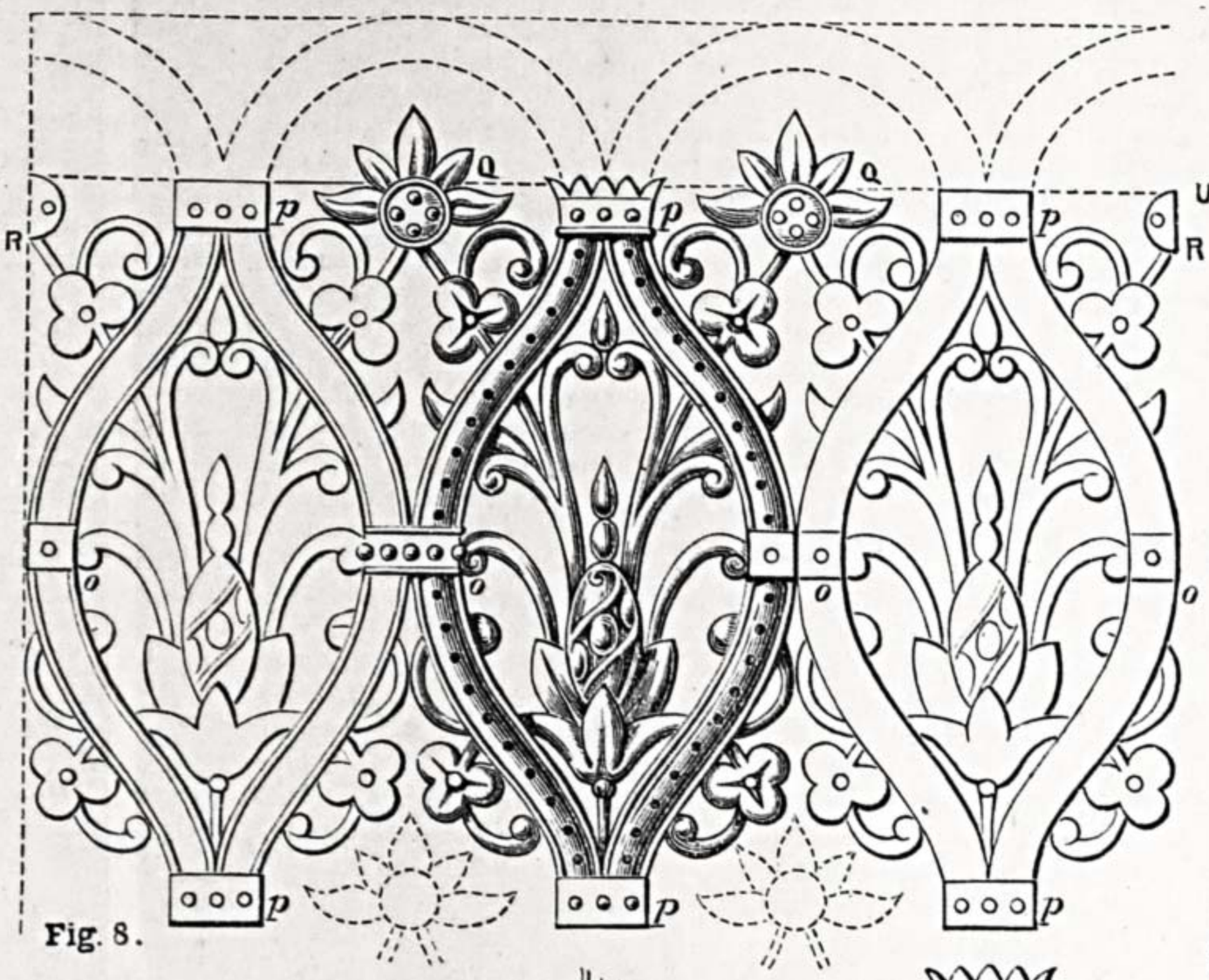

Fig. 8.

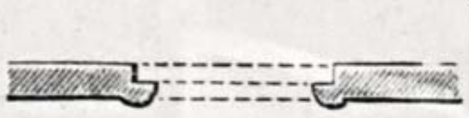

Fig. 7.

Fig. 6.

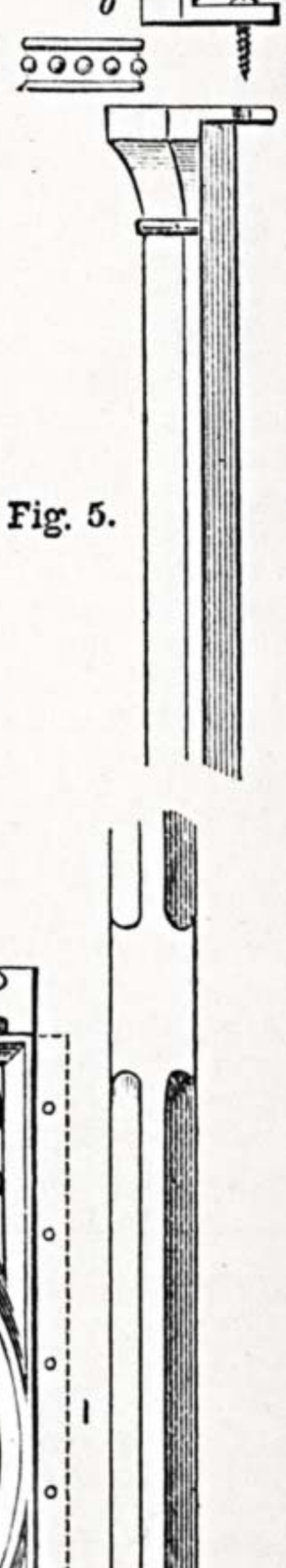

Fig. 5.

Fig. 10.

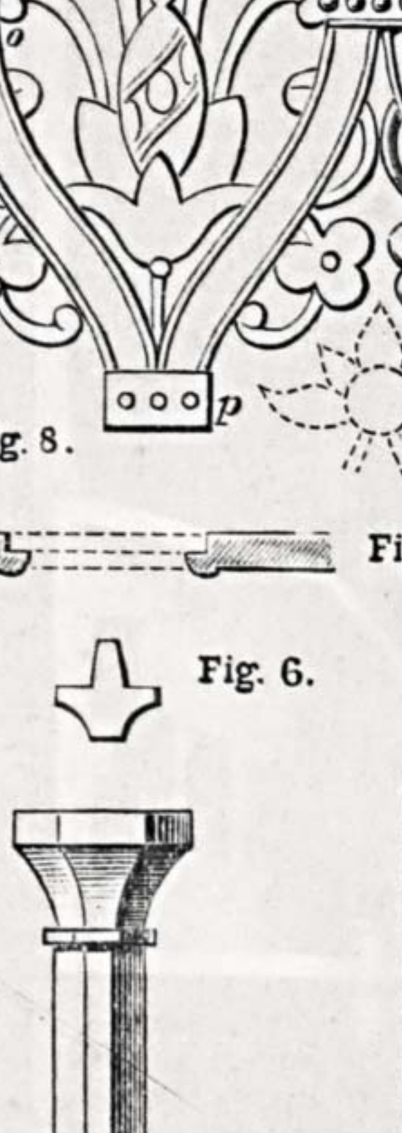

Fig. 4.

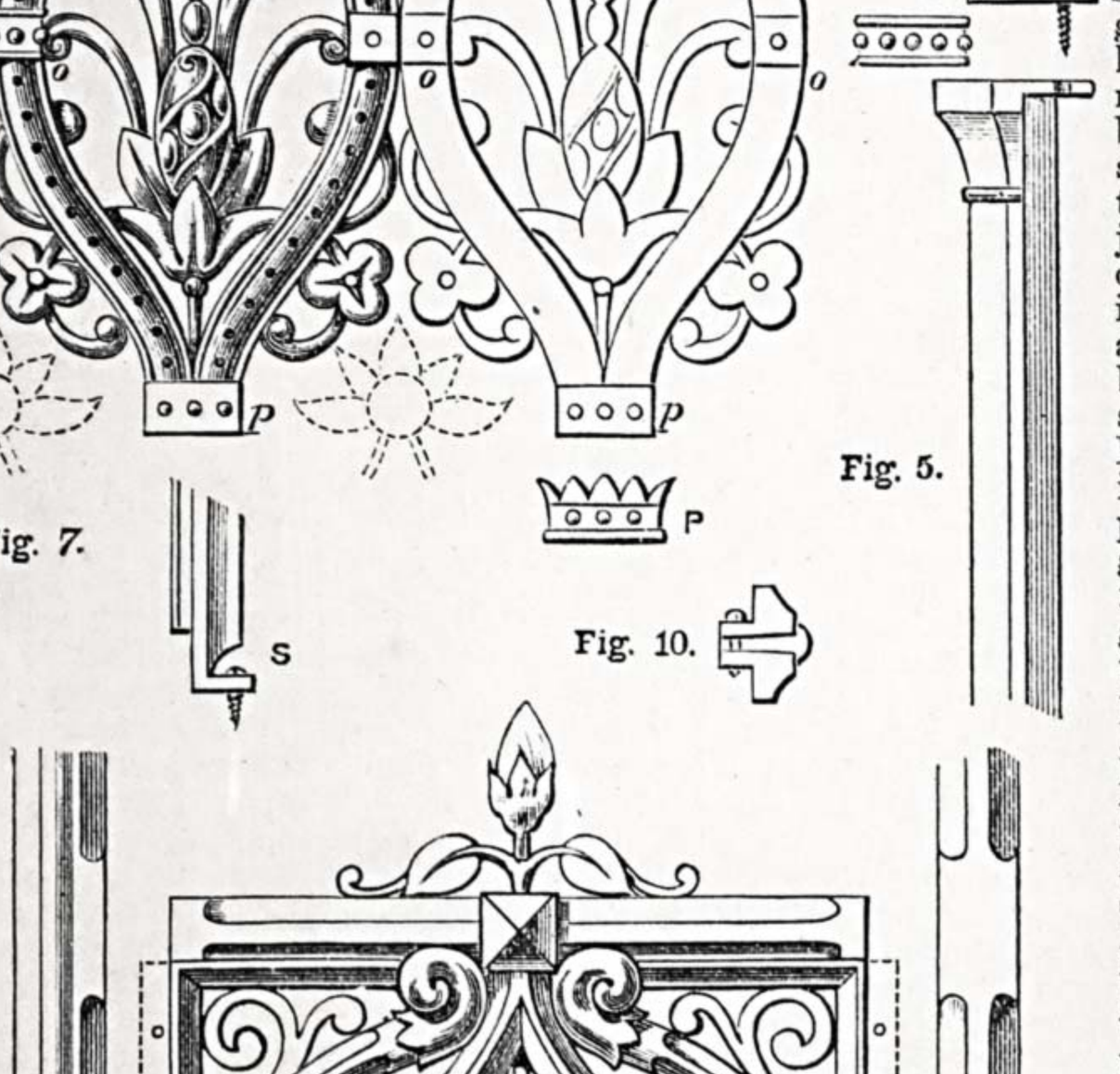

Fig. 2.

Fig. 2.—Panel for Bottom of Window. Fig. 4.—Mullion and Transom. Fig. 5.—Attachment of Head Panel to Mullion. Fig. 6.—Section of Glazing Bar. Fig. 7.—Rebate for Coloured Disc. Fig. 8.—Ornamental Window Panel. Fig. 10.—Section showing Mode of joining Square Forms.

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side will have to depend on the decorations of the room of which it forms part. But the inside colour will show but little: from within, seen against the light, the ironwork will tell as little else than black; gold only will tell upon it with much effect, and it may, therefore, be well to a certain extent to employ gold.

To speak then of the outer side. It is suggested that for the heavier, glass-carrying lines a deep dull red will, in a general way, be appropriate, and for the intermediate work a moderately deep dull green; the prominent parts in each being picked out with the opposite colour, whilst for certain specially prominent points and slight markings black or gold might be employed. As regards the use of gold, however, care will always be needed to avoid a "spotty" effect, and a gilded surface will often require a gilt line near adjacent to carry it off properly.

Again, bronzing would not be improper for our purpose. The whole frame might be painted of a dull green, and relieved in its prominent parts with bronze in the ordinary way. This would preserve its character as metal, and would look well, though whether it would have so artistic an effect as the former scheme may be doubted.

Mention has been made of iron glue for uniting into a solid mass parts which have been merely wedged or screwed together. It is familiar under some name or other to most practical iron-workers; but the amateur may need an explanation of it. The common way of making it is with iron filings and sulphuric acid. This laid on the parts before they are screwed together unites them so effectually that the joint becomes harder than other parts of the casting. It can, of course, only be used when no future unscrewing or taking to pieces is contemplated. It is said that the French claim that their "iron mastic" (as they call it) has more strength than ours: they use in addition a little sulphur.

In addition to their primary purpose, it may be found that our designs for iron window frames may be adapted (without glass, of course) to verandahs, balconies, and similar uses. It may be observed that the design Fig. 8 especially would make an exceedingly rich substitute for lattice-work.

HIVES AND OTHER APIARIAN APPLIANCES.

BY APIS.

WAX SMELTER—HONEY RIPENER AND STRAINER—FEEDERS—THE RAYNOR—DUMMY FEEDER—AMERICAN RAPID FEEDER.

A WAX smelter is a very useful piece of apparatus to have in an apiary, as by its means wax may be kept in a fluid state for a considerable time without any danger of being overheated.

It is on the well-known principle of the glue-pot: an outer vessel contains water, while the wax is placed in the inner one, which cannot then be made hotter than the boiling point of water. The manufacture of a smelter will be found to be a very nice job, entailing some rather clever tin work.

The outer case is oval, and rather like a tin tea-pot, for which it might, at first sight, be easily mistaken.

Its dimensions are $3\frac{1}{2}$ in. long, $2\frac{1}{2}$ in. wide, 3 in. high; the inner receptacle is $\frac{1}{2}$ in. smaller every way, so that $\frac{1}{4}$ in. is left between both for water and steam.

A pattern for the bottom of the water case should be cut from a piece of cardboard. To do this, drive two strong pins vertically in the cardboard $2\frac{7}{8}$ in. apart, and make a loop of thread $3\frac{1}{2}$ in. long; pass this loop over both pins, and run a pencil round the loop. An oval figure about 3 in. by 4 in. will then be described, as in Fig. 2.

This oval may be cut out of the cardboard with scissors, and used as a pattern by which the tin or copper for the smelter bottom can be marked. A $\frac{1}{4}$ in. may then be cut off the edge of the cardboard all round, and the bottom for the inner receptacle cut from the reduced pattern. It is much better to make the outer case at least, of copper, as it will last much longer than tin, be pleasanter to work, and look better. A smelter made of copper also is more valuable than a tin one, even beyond the difference in the value of the materials. If tin is used, acid should on no account be employed as a flux for the solder, as it would soon eat its way through the plates.

The sides of the outer case are formed of a strip of tin $3\frac{1}{8}$ in. wide and about $9\frac{7}{8}$ in. long. $\frac{1}{8}$ in. is turned over at each end, one end up, the other down; they are hooked together, hammered flat, and soldered. $\frac{1}{8}$ in. of one edge is then flanged out at right angles to receive the bottom, which has the same amount of its edge turned up and then down over the flange, the whole being finally hammered flat against the sides, as I described in the Little Wonder extractor.

The inner case may now be taken in hand, its dimensions being 3 in. long, 2 in. wide, $2\frac{1}{2}$ in. high, the strip which forms its sides $\frac{3}{4}$ in. shorter than that for the outer case, and the bottom $\frac{1}{4}$ in. smaller all round. The bottom and sides may be attached as in the outer shell, or the bottom may be flanged like the cover of a canister and soldered to the sides. The top had better be beaten into a dome shape, as shown in Fig. 1, for which a wooden block with a hollow gouged out to the correct size and shape will be required. The top is flanged down, and fits the body to which it is then soldered. A hole is made in the centre of the top to take a piece of light brass or tin tube $\frac{3}{4}$ in. in diameter and 1 in. long. A hole is also bored about 1 in. from the bottom to take the nozzle, which is a piece of tube 4 in. long, and tapering from $\frac{3}{8}$ in. to $\frac{1}{4}$ in., but it is not soldered in place yet. It would be well to solder three little feet $\frac{1}{4}$ in. high to the bottom of the inner case to keep it a proper distance from the outer; these can be of pieces of tin bent round to about the size of a lead pencil and cut the correct length.

A handle, as shown in Fig. 1, should be riveted to the outer case after the manner of a tin pannikin handle, and the top made to fit nicely over the sides. A hole should be made, and a bit of tubing soldered in the outer cover towards the handle, through which water is to be introduced into the boiler. An oval hole about 1 in. long and $\frac{3}{4}$ in. wide must be made over which the outer nozzle is soldered.

The inner case is now to be put into the other, and the smaller nozzle soldered firmly into place, having its point as high as the top of the smelter when horizontal. The soldering can easily be done through the large hole in the outer case. The top of the boiler may now be put on, the tube communicating with the inner receptacle passing through a hole made for its reception, and solder should be applied all round the tube and the top. The outer nozzle can then be soldered in place both to the boiler and the inner nozzle.

This will complete the smelter, which should, of course, be water-tight as to both the outer and inner receptacles. Corks may be used for the tubes on top, but it would be neater to have little brass caps to fit tightly or even to screw on. The wax is introduced into the smelter usually when in a molten state, but small pieces could be put through the tube if desired.

Care should be taken to have the inner case as nearly as possible concentric with the outer, so as to have the same space left for water all round. This, however, is not very difficult with the legs, if the hole in the boiler top is in the correct position.

A Honey Ripener, Fig. 3, may be made of any tin receptacle large enough to hold the quantity of extracted honey likely to be in hand at one time. A vessel 12 in. diameter and 18 in. high will, probably, hold more than most of my readers require. It can easily be made after the manner of the barrel extractor, having a wired edge top and bottom, and a honey valve soldered in the side close to the bottom. It is scarcely necessary to have the bottom sloping, as the can may be tilted over without much trouble, but most amateurs will find it easier to have the slope in the bottom. It will then be made a little larger than the space which it has to fill, and turned until it fits tightly all round against the sides of the can. The bottom might also be put in like that of a tin saucepan, with the folded joint such as we used in the smelter.

If this last plan is employed, it would be advisable to solder three or four circular pieces of tin, about the size of a crown and slightly saucer-shaped, to the bottom, to prevent it from being worn at its junction with the side.

A strainer might conveniently be added to the ripener. This is either of perforated tin, or simply a piece of muslin or cheesecloth. If the former, it should be made in the form of an inverted cone in such a way that the cover of the can will fit also over the strainer. It would be better also to have a rim of plain tin over the perforated cone, so that a quantity of honey could be poured in, and let percolate slowly through the holes.

If the muslin is decided on, all that is required is a rim which fits into the top of the can and holds the muslin all round. This rim can be made of doubled tin, 1 in. wide, first made into a hoop to fit the can, and then having a $\frac{1}{4}$ in. turned out at right angles over the wired edge of the can. The cover will fit over this as in the other.

Feeders are legion, but I will describe only those which I have made and used myself. One of the best for all round purposes is "The Raynor," of which I give three diagrams in Figs. 4, 5, and 6.

It will be seen to consist of a bottle with screw on cap, which is perforated with a dozen holes in a semicircle in such a way that one or more can be brought over the circular slot which is shown in the stand, Fig. 5. A pointer soldered to the cap indicates the number of holes which are uncovered to the bees underneath.

I make the base of my feeders of hard wood, turned to the section shown at Fig. 6. They are 6 or 7 in. across, and $1\frac{1}{2}$ in. high.

The recess in the top is made to fit the 2 lb. screw-top bottles, which can be bought from all dealers in bee appliances for about 4s. a dozen.

The top of the dome is turned to about

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$\frac{1}{8}$ in. thick, a circle marked round while in the lathe with the corner of the chisel, and the slot $\frac{1}{8}$ in. wide, cut out with a narrow chisel and penknife.

The slot is to be half the circle round—no more. The feeding bottle is then laid in place and holes pricked through its cap through the slot of the stand, with a darning-needle or fine awl. These holes may be about a dozen in number, as shown in Fig. 5. A pointer of tin must be soldered to the cap, and numbers stamped on the stand corresponding to the number of holes open.

When the bottle is inverted, the syrup will not run out of the holes, owing to the air pressure and capillary attraction, but the bees can easily suck the syrup through the holes. I frequently line the dome with cloth or chamois leather to keep it snug.

When I am in a hurry for a stand, I sometimes use a piece of pine 5 in. square, and tack a slip 1 in. wide and $\frac{3}{8}$ in. thick all round, as in Fig. 7. I then cut a hole right through the top large enough to take a tin canister cover of the correct size, which I flange over and secure in place with a couple of tacks.

I cut the slot in the tin and make the holes in the bottle cap as before, and the work is done. A pointer, of course, will be needed as before.

Another feeder on this principle is a dummy feeder, invented by, I think, Mr. Hone. A slit is cut in the dummy to enable the bees to take the syrup, which is contained in an oblong tin box with perforated edge placed at the back.

Fig. 8 is a section of the dummy and feeder which I used successfully as an experiment last season. The slot in the dummy is 6 in. long, and the tin box 8 in. by 5 in. by 2 in.; a dozen holes are made along the lower edge opposite the slit, and a screw plug and leather washer keep the hole through which the tin is filled perfectly tight. The tin is kept in place by two pieces of wood 2 in. by 5 in. by $\frac{3}{4}$ in., nailed edgeways to the dummy, and two other pieces 5 in. by 1 in. by $\frac{1}{2}$ in., nailed to the backs of these, so that $\frac{1}{4}$ in. embraces the back of the tin. The whole works like the female portion of a slide. A small strip (E) underneath prevents the tin from going too low.

If the screw cap is an objection, it could be replaced by a tube and good cork, an indiarubber one being the best.

For spring feeding, when only a small quantity of syrup is required to be given at a time, some of the holes in this feeder may be plugged up with wax.

The principal objection to all these feeders is that they must be frequently attended to, on account of the small quantity of syrup which they contain. This has been overcome in the American rapid feeders, of which there are many now in the market.

Fig. 9 is a general view, and Fig. 10 a cross section, of one of these feeders which I have in my possession.

It consists of a trough holding about 10 lbs. of syrup. This is supported over the brood nest by the ends and a pair of supplementary sides, which allow the bees free access to the top of the trough without permitting them to escape, a thin board acting as a cover. The vertical lines in Fig. 10 denote a sort of ladder made of very thin wood, its object being to prevent the bees being drowned in the trough.

To make this feeder, two pieces of clean pine $10\frac{1}{2}$ in. by $4\frac{3}{4}$ in. by 1 in. are made out for the ends. Rebates $1\frac{1}{8}$ in. wide by $\frac{5}{8}$ in. deep are then to be cut round three sides of each.

Two pieces 14 in. by $3\frac{1}{4}$ in., and one 14 in. by $9\frac{3}{4}$ in. by $\frac{3}{4}$ in., are to be got for the sides and bottom of the trough. This may be now completed by nailing the sides and bottom to the rebated parts of the ends, forming a trough $8\frac{1}{4}$ in. wide and $3\frac{1}{4}$ in. deep, and with the ends projecting $\frac{3}{8}$ in. beyond the sides and bottom.

The outer sides, which are $14\frac{3}{4}$ in. by $4\frac{3}{4}$ in. by $\frac{1}{2}$ in., are now to be nailed to the projecting parts of the ends, which will leave a space of $\frac{3}{8}$ in. between the sides of the trough and these outer sides.

If the whole structure be now laid upon a table, it will be found that the bottom of the trough is $\frac{3}{8}$ in. from the surface of the

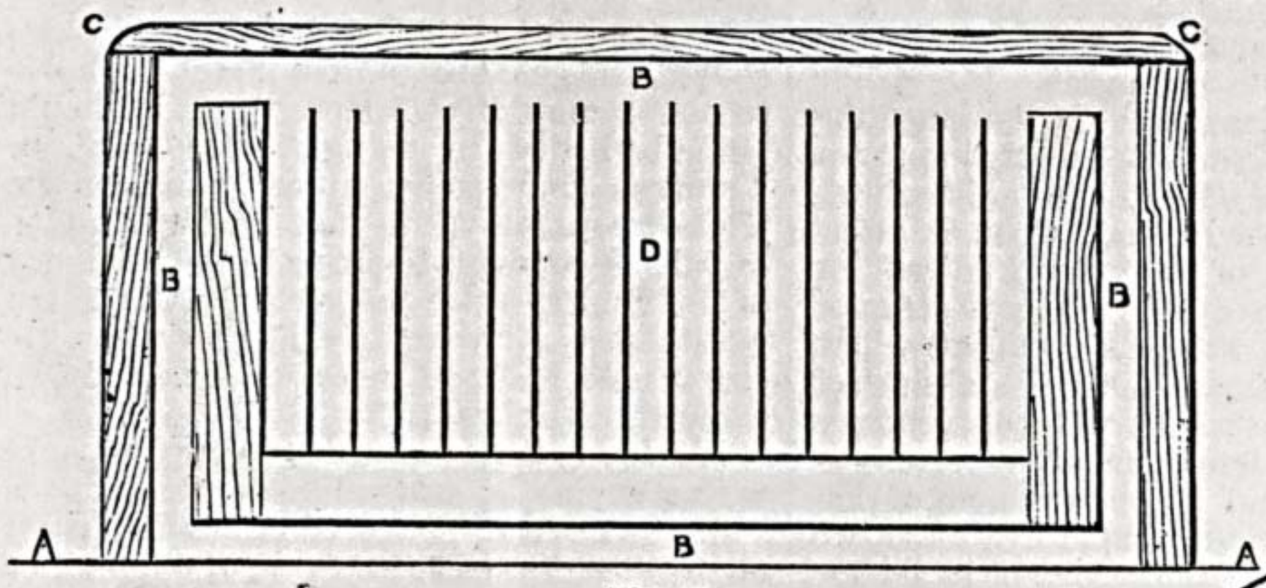

Fig. 10.

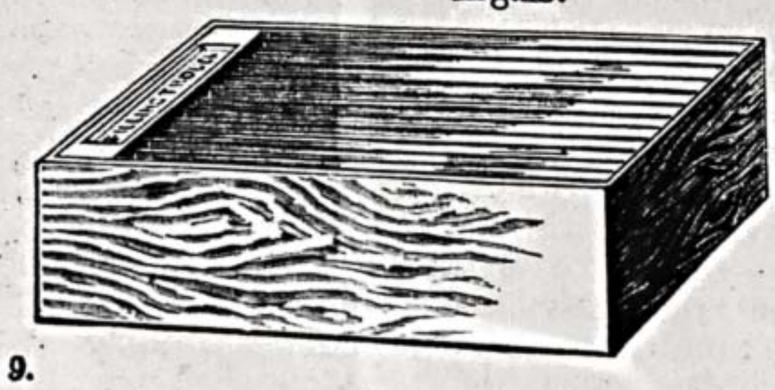

Fig. 9.

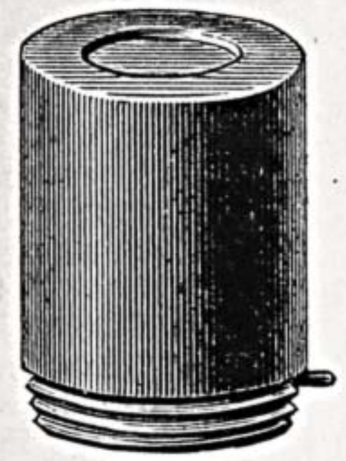

Fig. 4.

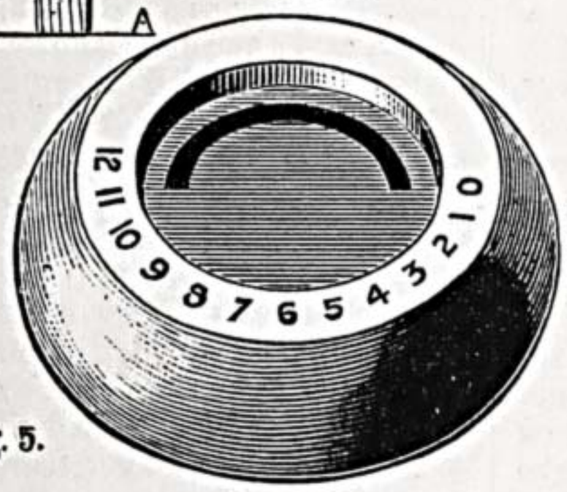

Fig. 5.

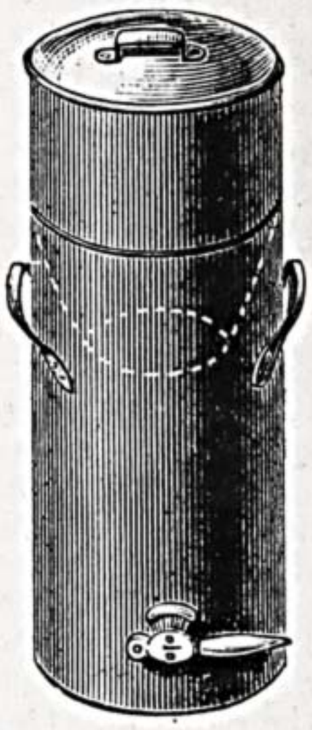

Fig. 3.

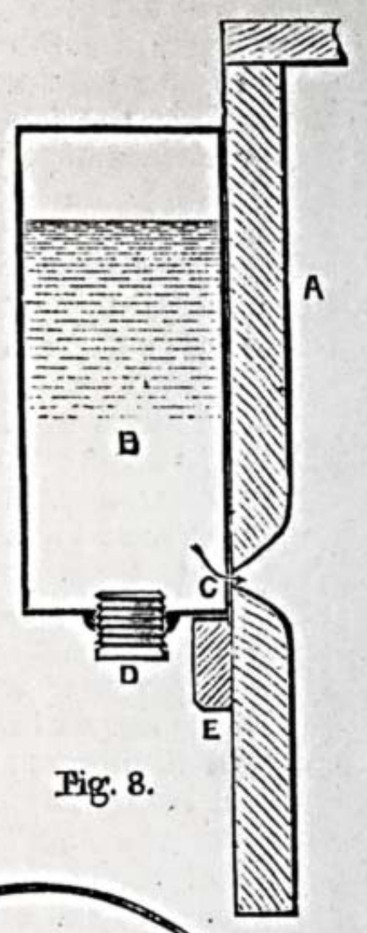

Fig. 8.

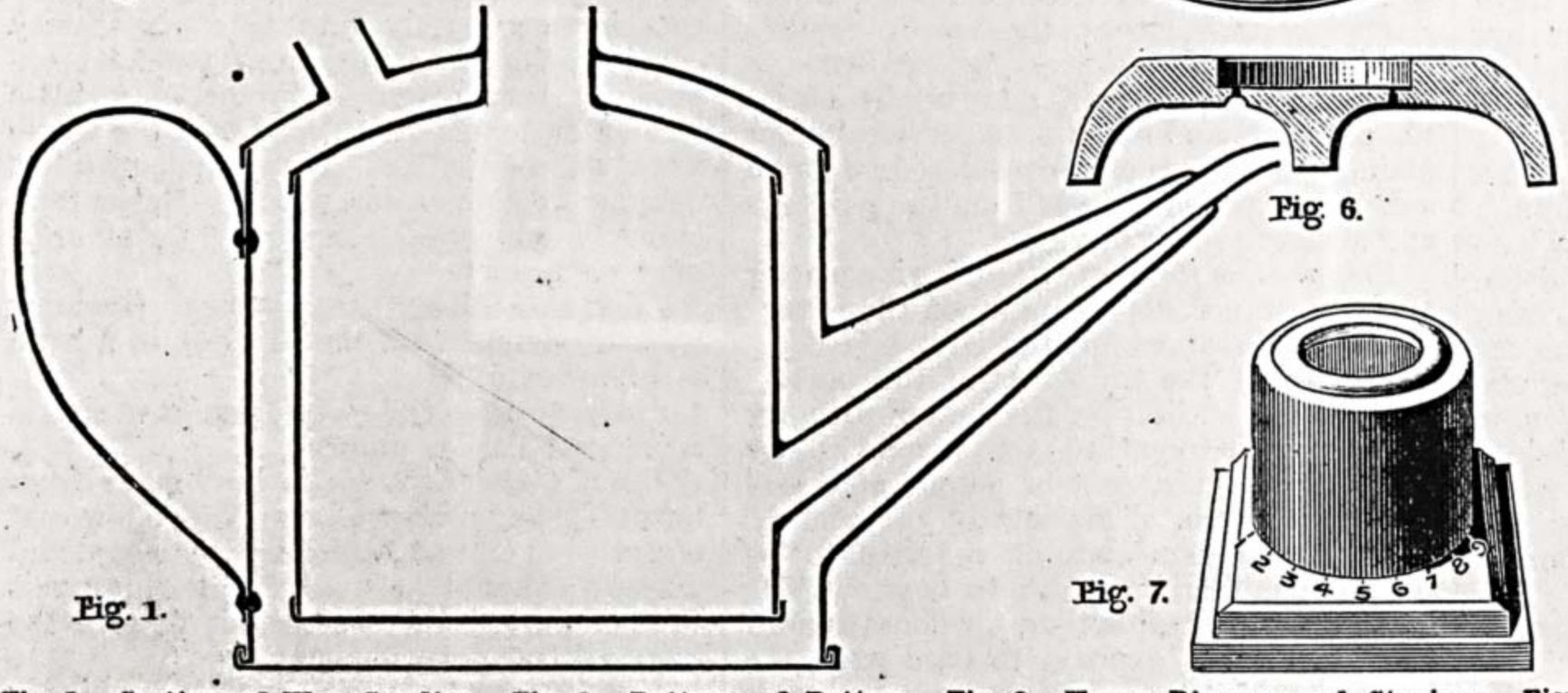

Fig. 1.

Fig. 6.

Fig. 7.

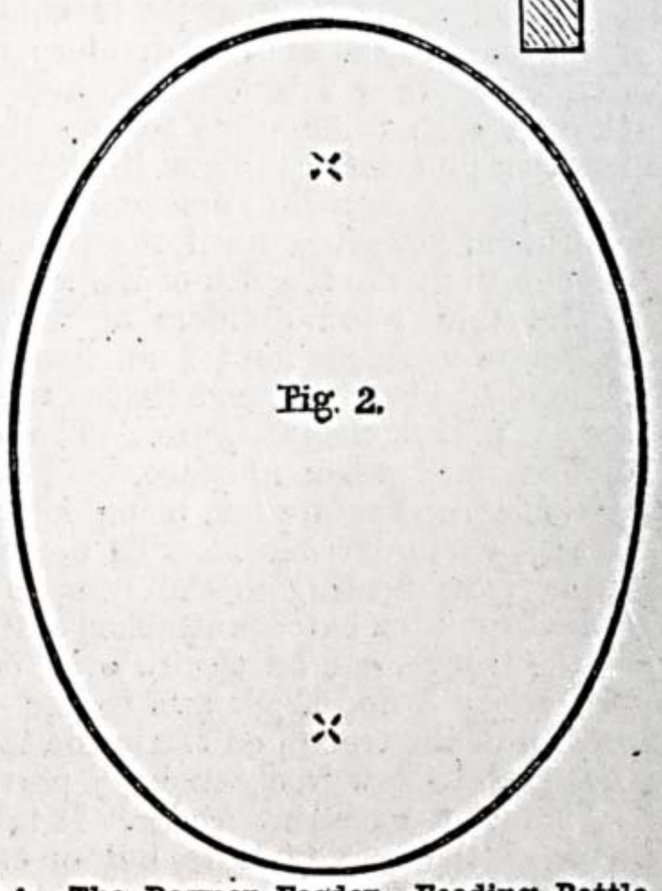

Fig. 2.

Fig. 1.—Section of Wax Smelter. Fig. 2.—Pattern of Bottom. Fig. 3.—Honey Ripener and Strainer. Fig. 4.—The Raynor Feeder: Feeding Bottle. Fig. 5.—Ditto, Stand. Fig. 6.—Ditto, Section of Stand. Fig. 7.—Square Base Feeder. Fig. 8.—Section of Hone's Dummy Feeder—A, Dummy; B, Syrup; C, Holes; D, Screw Cap; E, Slip to sustain Tin. Fig. 9.—General View of Rapid Feeder. Fig. 10.—Cross Section of Ditto—A A, Level of Top of Frames; B, Bee Space; C C, Top; D, Trough.

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table. A partition is now placed 1 in. from the end of the trough to form a filling space. This partition is pierced with ⅛ in. holes, so that when the syrup is poured into the smaller compartment, it will run into the larger, which can thus be filled without removing its cover. The cover may now be made of ¼ in. stuff of such a size as to cover the larger compartment: viz., 10½ in. by 13 in., and a couple of little cleats put on to prevent it from warping. If an examination is now made, it will be found that the bees can crawl up between the inner and outer sides of the feeder and over the side of the trough into the food. A careful examination at this stage will show the course the bees will take; and if any passage is less than ¾ in., it should be enlarged. The top edge of the trough will evidently be ⅜ in. lower than the sides of the feeders and the under surface of the cover. The bees could, at this stage, find their way into the smaller or filling compartment through small spaces which communicate with the hives. These can now be stopped up with scraps of wood tacked over them, and a long narrow strip of glass cut to cover the compartment.

The ladder which enables the bees to take the food without the risk of being drowned can now be made. About the best material to employ is the wooden dividers which are used to separate the sections in the section crate. They can be cut 12 in. by 3½ in., and seventeen or eighteen of them will be required. Twice as many pieces of wood ⅜ in. thick by about ⅞ in. by 1¼ in. will also be required. One of the thin dividers is then taken and marked with a pencil 3½ in. from each end. A couple of the small pieces of the wood are then laid on these marks and equidistant from the edges of the divider; another divider is then laid on top, and a tack through each thick piece secures the three together; another couple of thick pieces are put next, again a thin one, and the tacking continued as before until the pile is high enough to fit the breadth of the trough.

The thin wood dividers of which this ladder is made are kept ⅜ in. apart by the little blocks between, and that is the whole secret of its manufacture. The outside dividers will, when in place, be ¾ in. from the sides of the trough, being kept so far away by similar blocks. To prevent the ladder from floating in the syrup, a couple of little wooden buttons attached to the sides of the trough can be turned over it, while two strips ⅛ in. thick are tacked to the bottom of the trough on the inside to enable the syrup to flow freely to every part.

This is an excellent feeder. It takes the place of the section crate, but of course is only suitable for use in the autumn, when stocks have to be fed up rapidly before the winter.

THE ART OF GRAINING.

BY A LONDON DECORATOR.

IMITATIONS OF WOODS BY PLAIN STAINING AND GRAINING UPON UNPAINTED WOOD.

The Practice of Staining light and inexpensive woods to the colours of more rich and costly varieties is a branch of graining—"sham" though it still is—that few persons will object to. The advantage of being able to get a permanent and decorative finish upon new wood without the important outlay of preparatory painting is so apparent to all, that a first place of interest will readily be given to a paper dealing with such.

Under this heading we have two distinct treatments of imitations—the first wherein the colour effect alone is sought after; and the other, that in which the figure and particular characteristics of the wood are also imitated. Without attempting to follow the theory of the matter beyond the simplest lines of consideration, it will be readily granted that both of these methods have their proper sphere and limitations. The description and quality of the wood stained is a most important factor of its successful treatment. For instance, we may stain white wood with the colours of light oak or maple, and obtain a rich and satisfying effect. Apply, however, the same transparent glaze to sappy and knotty deal, or, on the other hand, to light pine with a strongly marked grain, and we feel at once colour and grain do not agree. Pitch pine of the ordinary class, such as its imitation described in No. 84, may be greatly improved by staining to the effect of American walnut; but were we to grain upon it afterwards the figure of ordinary knotted, or Italian, walnut, then an unnatural attempt at combination is at once apparent. The very common and popular red staining of the poorest and cheapest articles of furniture—presumably in imitation of mahogany—strikes in the mind at once a note of discord. Mahogany is an expensive wood, we know, and therefore imitations of its colour on wooden rubbish are rather objectionable. Then, again, the colour of even the cheapest mahogany cannot be obtained by a bare coating of stain, so that it is not satisfactory from either point—consistency or appearance. Mahogany, walnut, maple, and other choice woods—particularly those which are best imitated in distemper colour—can, however, be beautifully grained upon prepared plain wood, with results almost equal to anything we may execute upon painted grounds. As in most of these dark varieties it is necessary to first stain the wood a general colour, we will now briefly notice the pigments and fluids most serviceable for plain-staining purposes, considered not from a dyer's or polisher's, but from the painter's and grainer's point of view.

Preparation for Plain Staining is a matter of circumstance, depending upon the nature of the wood stained and of that to be colour-imitated. If the timber is of the poorest quality, soft and sappy, the better plan for cheap work is to ensure more regular colour by first giving it a coat of patent glue size of fair strength. This is no "lost labour," since all common staining requires to be sized to enable the varnish to bear out. It is, however, advisable that, for floors and all similar surfaces exposed to hard wear, the stain should be applied first; otherwise, instead of sinking into the wood, the colour is merely lying on the surface, and is more easily worn away. In dealing with ordinary house woodwork, cheap panellings, etc., the size before oil-stain is recommended. When the former is dry, it will be found that the oil-stain, or "graining colour," can be spread much better and more regularly, and that those sappy places which would otherwise have absorbed much stain are scarely noticeable. In sizing white or stained wood, poor work often results from the "quirks" and mitres of mouldings being overcharged with the "froth" of the warm size. This can be easily avoided by adding a little turpentine—about one teaspoonful to the pint of size—which will prevent much of this "frothing" nuisance. For preparing a higher class of woodwork the colour of which we chiefly desire to alter, there are several better methods open to us. When we have a good specimen of pitch pine which is required to be stained down, say to an American walnut shade—and in which it is most effective—we may first coat it with either japanner's gold-size diluted with one-third of turpentine; or with raw linseed oil, a little "turps," and about one-tenth part of good liquid driers, or terebine. The dilute gold-size is the most costly and quickest, as it may be stained upon in a few hours; but for equal permanence and cheapness the drying-oil is the best. Both are brushed on in the same manner as varnish is applied, only rather more sparingly. When plain-staining or varnishing very white wood, it is often necessary to avoid all possible after-discoloration arising from the oil darkening with age; and since it is prepared from the same source, the gold-size, unfortunately, is liable to the same defect. Here, then, it should be substituted by using "clear" size, or Young's colourless patent size, and then the whitest copal oil varnish for the finish. One drawback common to sizing is the tendency of the fluid to raise the surface grain of the wood: this is particularly the case when the size is used hot, and therefore such must be avoided.

Mixing Oil Stains—viz., those prepared with a drying-oil and painter's pigments—is a simple matter. We may take three parts oil to one of turpentine, add the liquid, or even paste, driers as above-mentioned, and then the simple addition of "stainer" completes the mixture. As advised for preparatory coating, Japan gold-size and "turps" may be used for the liquid, or, better still, copal varnish may be stained and diluted with "turps." The advantage of using the two last-mentioned is their quickness of hardening; whilst the cheaper oil mixtures are far better for spreading evenly and regularly over large surfaces. I have gone somewhat minutely into this preparatory consideration, knowing from practical experience how often the want of a little elementary explanation will mar the whole work on completion. I now append a few details of colour-stains, which, with the foregoing, should suffice the worker for all ordinary purposes:—

Light Oak Oil-stain may be made from raw terra di sienna, with the addition of a little raw Turkey umber.

Medium Oak Oil-stain from raw sienna and burnt Turkey umber.

Dark Oak Oil-stain is best made from burnt Turkey umber alone; the yellow cast of the copal varnish, which it is supposed and intended should be used for finishing this class of work, is here sufficient to give the required trace of yellowness.

For Antique Oak-stain, a mixture of ivory black, finely ground, with a very little burnt sienna. Vandyke brown alone makes a deep rich stain, its colour, when ground in oil, being not so red as when used in distemper. This pigment, being a notably bad drier, requires fully double the usual quantity of terebine added to the oil fluid.

Walnut Oil-stain for varnishing upon, without any after glazing and figuring, may be coloured with burnt Turkey umber and a little ivory black. For a "ground-colour" stain—viz., whereon we wish to grain walnut figure—raw umber is the better pigment, since its subdued tone contrasts more naturally with the after figure work.

Oil-stains for Pitch Pine.—Raw sienna, with the addition of a little burnt ditto, make a rich pine colour for staining on light wood; a little burnt umber can be added if the siennas alone are too red. Real pitch pine is very largely used for house woodwork

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at the present time, especially in the neighbourhood of seaport towns, when it is usually imported direct from the Baltic. In most instances the pine is cheaply prepared, and varnished with copal. The presence of so much resin and matter of a discolouring nature in pitch pine soon causes a very appreciable darkening of the original colour; hence, when it is desirous to keep the wood permanently light, the copal varnish used should be of the whitest make, and the size be either "Young's Patent," strong "parchment," or the special "light japanners." All holes, etc., should be carefully stopped with common putty of two shades, coloured to match both the ground and grain of the wood, *after the sizing*. A day or so to allow it to harden before varnishing is advisable. When the real pine is desired to be stained much darker, besides the umbers, vandyke brown, and black pigments, we may use diluted washes of either black japan or Brunswick black. Only those of a thoroughly good quality should be used, and with pure turpentine for thinning. Messrs. Mander Bros., the well-known Wolverhampton firm, make an "antique oak" stain, which is an admirable article for this purpose. It is rather costly, but, being a strong and powerful liquid, it stands much dilution; whilst, being purely an oil-stain, it can be worked and spread better than the quick-drying preparations of the two previous articles. When staining pine dark, it is preferable to use the stain *before* sizing; if the grain is desired to be very prominent, a full coat should be spread, and then shortly afterwards all the stain lying on the surface may be rubbed off with old cloth or rag free from "fluffiness."

Mahogany Oil-stain can scarcely be obtained of a good colour by ordinary brush staining. Burnt sienna alone is somewhat gairish; and the only perfect substitute for the Victoria lake used in distemper graining is madder lake, which is too expensive for ordinary cases. Whenever cheap mahogany stain is required, it should be made nearest to ordinary baywood. For furniture and "better-class" work, a good mahogany effect may be obtained by oil-staining with burnt sienna and vandyke, and, when dry, over-glazing with ordinary Victoria or mahogany lake in water. If the wood is at all sappy and strong in markings of a nature contrary to mahogany, it must first be sized, stopped, and then oil-stained.

Cheap Water-stains may easily be made from any of the above pigments. Whether used for oil or water mixtures, they should always be purchased ready ground and of decorators' quality, those in pound and half-pound collapsible tubes being by far the best and cheapest for good work. Nearly all these colours have a natural binding quality with water alone, but the addition of a little beer will easily secure the stains of ivory or vegetable black. Water-stains must always be applied directly upon the wood; we therefore are at a double disadvantage when using such. The stain itself has no "filling" power, so that a *second* coat of either size or varnish is necessary; and water-stain does not spread so nicely with the brush as oil. A piece of sponge is preferable for using the former, and the best effect is got by wiping all superfluous stain off the surface.

Maple and Satin-wood Imitations, when grained on white wood, are executed with the same water pigments and process as upon paint. The wood for these two varieties must be very free from grain or knot, and must first be once sized and varnished with the whitest materials. This gives a non-absorbent ground for working the distemper stains upon. When the figure is completed, another good coat of varnish gives a capital surface.

Walnut, mahogany, and similar dark woods must have the grounds sized, and then coloured with oil-stain to the nearest shade of the usual grounding paint. The size and stain together will suffice for working upon, but two coats of varnish are required for dark imitations of this kind. With walnut and mahogany the first coating is applied *barely* before the glazing, and a final flowing coat afterwards.

Notwithstanding this paper is compiled solely with reference to the painter's and grainer's usual work and requirements, the simplicity of most of these preparations will commend them to the occasional wants of all readers. A saving of labour is nowadays a primary consideration, and in this connection oil-stains, requiring only *once* sizing, are most useful. For floors or other large surfaces, the advantages of using the "Scumbling," or staining, preparation of Mathieson Bros., Ardrossan, near Glasgow, are worth mentioning here. They consist of prepared drying pigments, requiring only linseed-oil for dilution. They are both cheap and good. (See Vol. II., No. 69). With the "semi-chemical" stains of dyer and polisher we have no concern here, although in a short lesson on inlaying methods some particulars of other permanent *coloured* stains will be given.

Flat Varnishing or Dull Polishing may be used to much advantage in finishing any kind of copal-varnished or oil-stained surface. A simple preparation of the former can be made from a piece of genuine beeswax (size of walnut) dissolved, and thoroughly mixed by heat in pure turpentine (½ pint), and 1 oz. copal varnish added thereto. The latter method may be done by carefully dulling either varnish or polish with finely-ground pumice-stone and felt (or a piece of soft cloth), used with water; then rubbing with putty-powder and Lucca oil for a final soft gloss.

PARAFFIN LAMPS.

BY THOMASO.

SMALL HAND LAMP — SPIRIT LAMP — HANGING LAMPS.

FIG. 12 is a handy, inexpensive little lamp, suitable for any purpose requiring only a moderate amount of light, such as to carry about when looking for anything. Its shape allows it to be hung up anywhere, stood between shelves without burning the one above it, or held close to the ceiling without blackening it.

The burner I took off of one of the very small tin lamps, sold at 6½d., having a wick about ¼ in. wide. It gives a fairly good light considering, but it wants cleaning frequently.

I made my lamp of tin, but I find it has got rusty inside. Sheet brass is the best metal to make it of.

Cut a circular piece 4 in. in diameter. Draw a line across the centre, and $\frac{5}{16}$ in. from each end punch an ⅛ in. screw hole, and cut a hole in the centre a trifle smaller than the screw collar of the burner, which is to be well scraped and soldered on from the inside. This is a neat way of soldering on burners. The other lamps can be done the same way. See that when the burner is screwed on, the wick-winder comes midway between the holes you punched. Cut the bottom ½ in. smaller all round than the top; lay it on the top, and mark round it for a guide in soldering the sides. Cut the piece to go round the sides 2 in. high, and solder it on to the top, joining the ends as described in the reading-lamp. Cut a 3¾ in. circle of brass, draw a line across the centre, and out of the middle cut a 2 in. circle, leaving a ring-shaped piece. Punch an ⅛ in. hole each side of this hole on the line you marked $\frac{5}{16}$ in. from the outer edge, and punch holes in two pieces of brass the size of a sixpence. Cut two pieces of ⅛ in. brass or tinned iron wire, 8 in. long, and bend one end of each into a loop first, as shown by the dotted lines of Fig. 13, and then backwards. Neglect of the backward bend gives these sort of loops a clumsy, amateurish appearance. Now push the wires through the holes in the ring, the brass sixpences, and the top of the reservoir, and solder them on the under side. When quite even, you can solder in the bottom, and solder the ring to the wires about 6 in. from the top of the reservoir. You will, of course, put the solder on the under side of the ring, so that it does not show. Now bend a piece of wire to form the handle to carry it by, make loops on the ends same size and way as the others, link them together, and close up. To make the little cap over the top of the chimney, cut a 3 in. circle of brass, cut a wedge-shaped piece out of it ($\frac{1}{8}$th of its circumference), then lap the edges and rivet; the smaller the rivet the better. You can solder the join if you like, as the heat would not be sufficient to melt the solder. Cut two strips of brass, ⅜ in. wide, bend them as shown in Fig. 14 (full size), and solder one end of each on the under side of the ring at the top of the lamp. The cap can now be slipped into the free ends of the slips, as shown in Fig. 14, the black line representing the section of the cap.

Cut a 4¾ in. circle of brass for the shade. Cut a hole in the middle to admit the chimney, and a piece out as you did for the conical cap, but only $\frac{1}{12}$th of the circumference, lap the edges, solder, and finish up with a file. Cut a notch each side of this shade for the wires to go in, and then solder the little pieces of brass, which you left loose on each side wire, at about 2¾ in. from the top of the reservoir. Now, when the shade is put on, the side wires should fit the notches, and hold the shade firmly, the little discs of brass supporting it. Polish up the shade and the rest of the lamp brightly. I prefer brass to plated copper for reflectors for such purposes as this. They are practically everlasting—there being no silver to rub off—and the difference is very slight.

This lamp is perfectly safe. I have knocked it on to the floor a number of times, and the only result has been darkness. I had to pay for my unintentional experiments though, in the shape of new chimneys. As to simple upsets they are too common to notice.

Fig. 15 is a little spirit lamp which I have found useful. The wick tube being cut at the angle shown, permits the flame to be directed downwards, if required, better than if the tube was cut parallel to the base—height 2 in., diameter 3½ in., size of tube say ½ in. Make a small hole near the top of the tube to draw the wick up by, and make a cap to prevent the spirit evaporating when not in use. A small brass bottle-top should be soldered in the top for filling purposes.

Some sheet metal workers may perhaps feel inclined to take exception to the method described of making joins in the sheet-brass work without any overlapping edges. To

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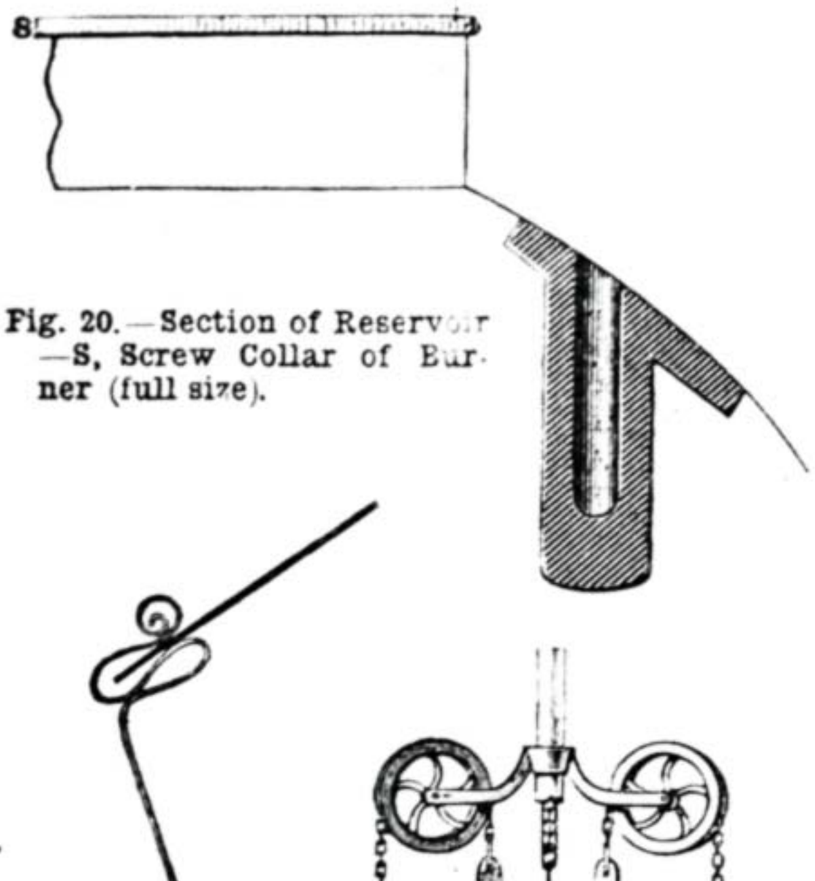


Fig. 20.—Section of Reservoir —S, Screw Collar of Burner (full size).

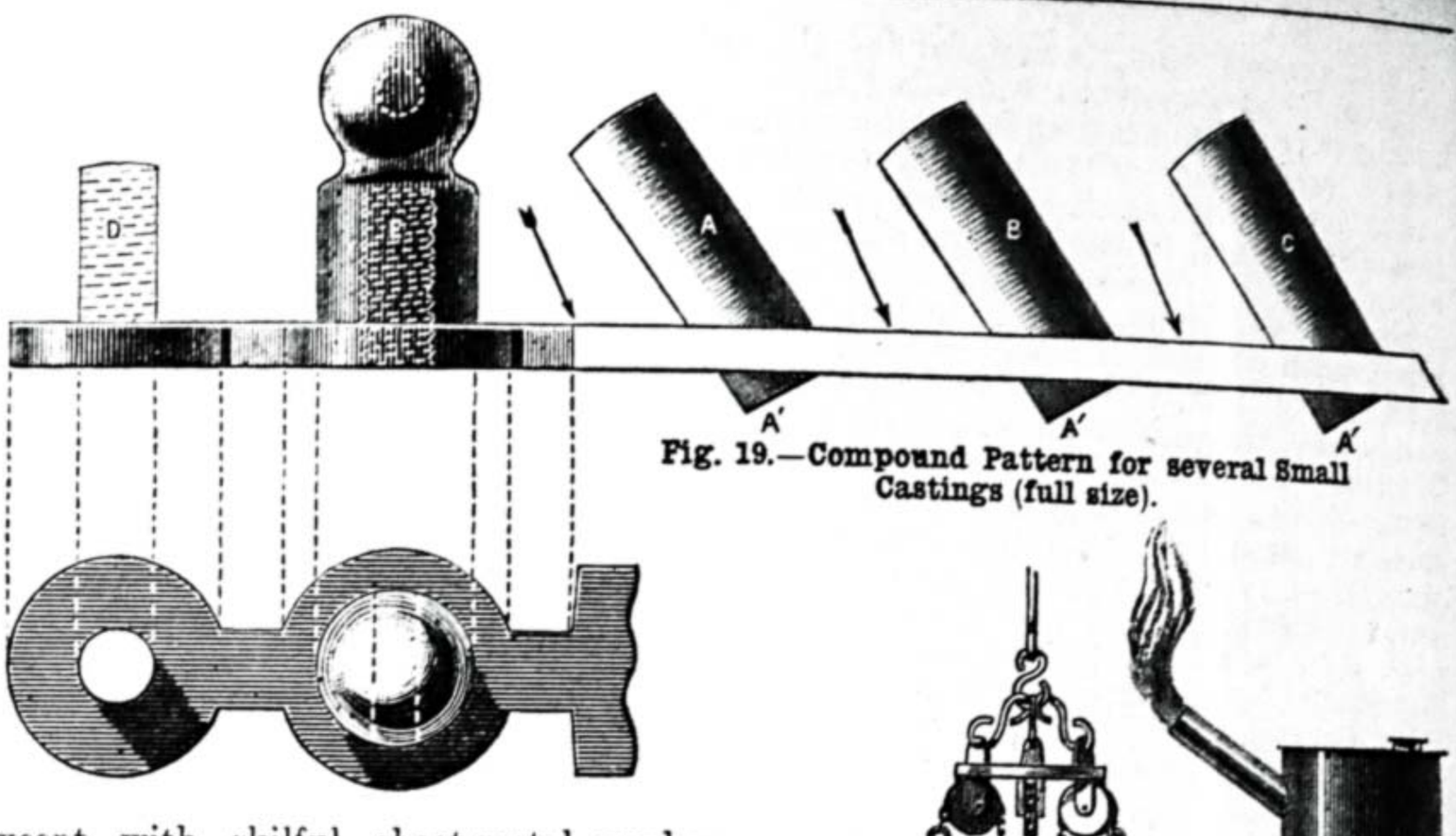


Fig. 19.—Compound Pattern for several Small Castings (full size).

Fig. 14.—Clip for holding Cap.

Fig. 13.—Loop.

Fig. 16.—Hanging Lamp, complete.

except with skilful sheet-metal workers. Amateurs would almost certainly fail to get nice lapped edges round curved work, even supposing the necessary tools were at hand.

The next lamp to be described is a hanging lamp. This style of lamp seems very popular, is certainly ornamental, and very useful if you are in the habit of dealing with large drawings or plans that need all the table for their support. But the special function of a hanging lamp is to illuminate a room, and accordingly I have designed a lamp which is suitable for any room from dining or drawing-room downwards. It is made of polished brass throughout, and of a simple pattern. The simplicity of the pattern is, I think, its chief recommenda-

Fig. 22.—Method of joining Flat Brass Wire (full size).

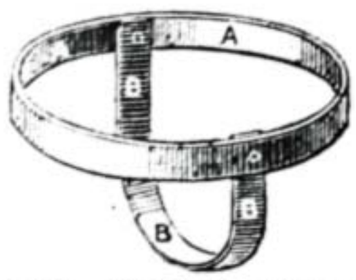
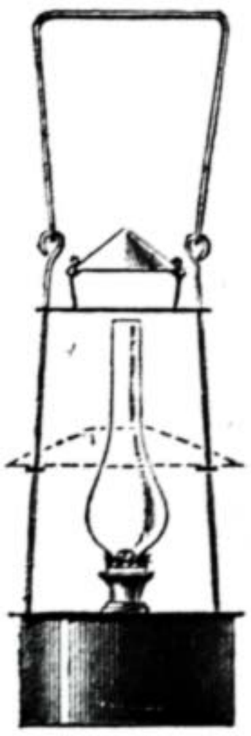


Fig. 21.—Ring to support Reservoir.



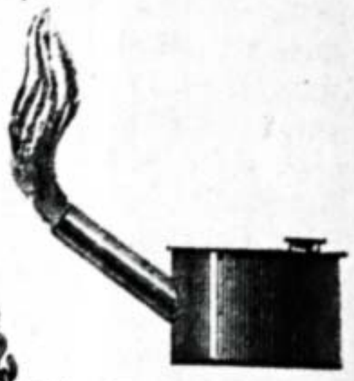


Fig. 15.—Spirit Lamp.

Fig. 18.—Section of Edge of Brass Hemisphere.

Fig. 17.—Alternative Form of Hanging Lamp.

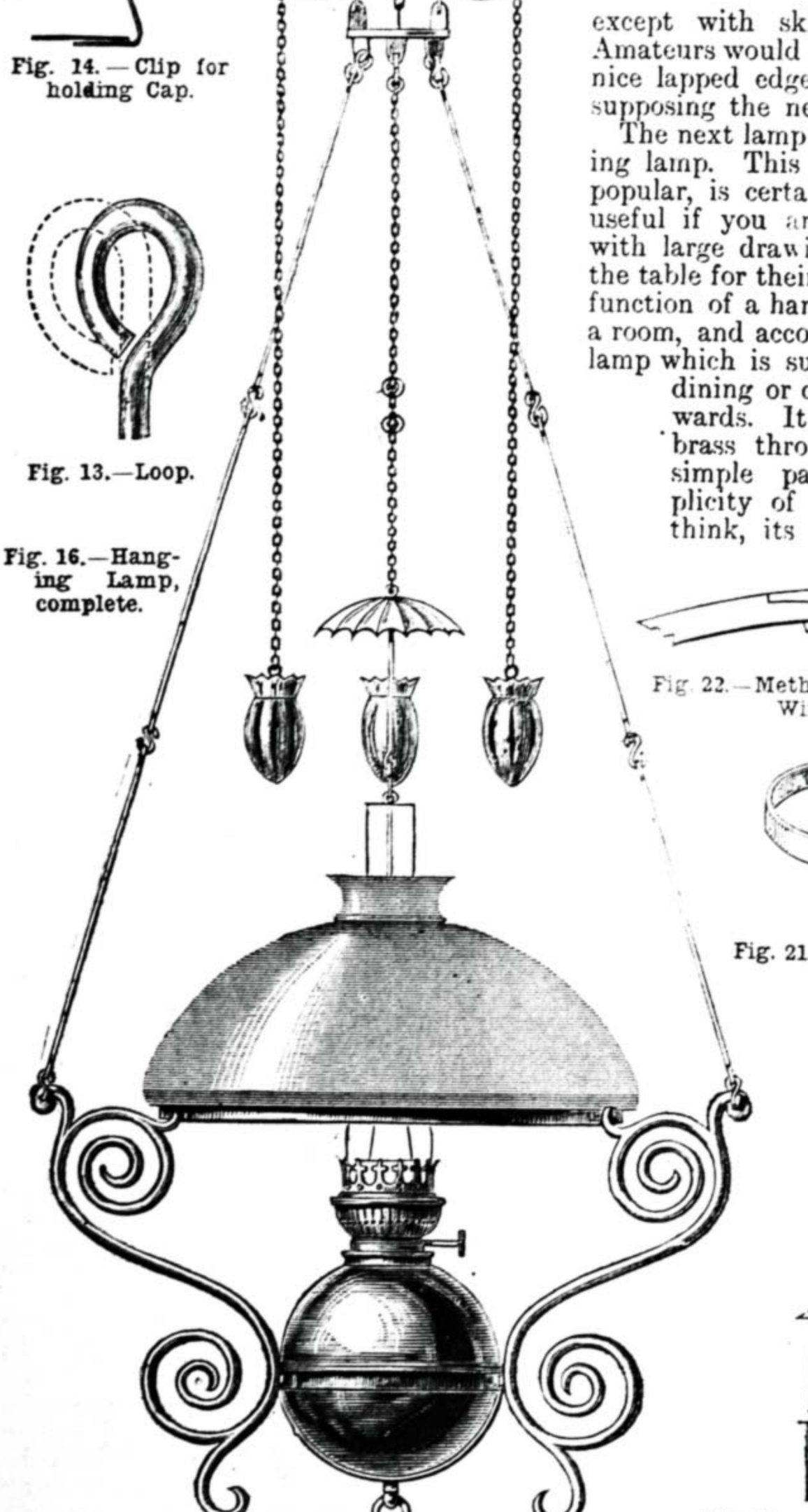


Fig. 12.—Small Lamp, complete.

such an objection I can only remark "that the proof of the pudding is in the eating," and the same remark, with some slight alteration, is applicable to the present case. The joins made as described are strong, do not leak, and, being out of sight, are quite good enough for the purpose. Indeed, I think that it is a case of Hobson's choice, tion—it is such a complete contrast to the flimsy, intricate metal work found in the cheaper kinds of over-ornamented lamps.

In Figs. 16 and 17 different modes of suspending the lamps are given. The first (Fig. 16) is intended to replace a gas chandelier, the wheels at the top of the latter over which the chain passes being retained. The chain, and probably the weights belonging to the chandelier, might also be used for the lamp. This method has one drawback. The long piece of tube, which is left behind when you take down the chandelier, must be cut off just below the wheels, causing a lot of trouble if it is desired to resume the gas.

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The other lamp (Fig. 17) is intended to be suspended from a hook screwed into the ceiling. This method is much to be preferred, as it does not interfere with existing gas-fittings. The damage to the ceiling is not worth mentioning. All that is necessary in the way of repairs, should you no longer require the lamp in that position, is a small plug of wood knocked gently into the hole left by the screw, until it is flush with the ceiling. A little whiting and water applied on the finger finishes the job.

We will start on Fig. 16. The oil reservoir is composed of two hemispheres of brass (the trade name of which I believe is "shells") soldered together to form a ball $5\frac{1}{2}$ in. in diameter. They, and other shapes, can be obtained of Messrs. Stanton, 73, Shoe Lane, E.C., for about 1s. 6d. the pair. See they are neither dinted nor cracked. The edges of both halves are turned outwards and upwards like Fig. 18. With the soldering-iron tin the whole of the inside of both halves. This is necessary to prevent leakage—the brass being so tortured into shape that it is very probable fractures exist which are too small to be detected until the paraffin is put in on the completion of the lamp.

Find the exact centre of each half, and then drill a small hole there. Cut a hole in the half intended for the top (which should be the best one, by the way) $\frac{1}{16}$ in. smaller all round than the collar into which the burner screws. Before cutting out, however, mark another circle with the compasses, about $\frac{1}{2}$ in. larger all round, and divide it into three. Solder on the collar from the inside. Drill holes at the three places marked on the larger circle, and enlarge them with a broach or round file, letting the edge of the metal rest on the bench and holding the tool perpendicularly. Make them large enough to admit a piece of $\frac{1}{8}$ in. wire when held in the same position as the broach while enlarging the holes.

A pattern must now be made like Fig. 19 (full size), and a brass casting obtained. Divide it where indicated by the arrows. A, B, and C are to have a $\frac{1}{8}$ in. hole drilled nearly through them, the little bit of metal A^1 being cast on as shown in order to enable you to start the drill. File up A, B, and C to roughly fit the curved surface, and then solder one under each of the three holes in the top of the reservoir. The section, Fig. 20, should make this clear. The utility of these holes will be seen presently, when I come to the description of another kind of lamp. The piece D, Fig. 19, is to have a screw thread cut on it, and the hole in the bottom of the reservoir is enlarged to admit it from the inside. When the screw is projecting evenly, solder it firmly on the inside. E, Fig. 19, is to be drilled and tapped to fit this screw, as shown by the dotted lines. A hole is also to be drilled transversely to admit a wire ring to pull the lamps down by. Be careful with the soldering, as, if anything went wrong inside, the reservoir would have to be separated—an awkward job. Always brighten up the metal where the solder is to go.

File the edges of the two halves, and finish off with a rub on a sheet of emery cloth. On putting them together, only a trace of the join should be seen. Secure them in place with a dot of solder here and there outside, and then solder all round from the inside. To do this it will be necessary to drop little bits of solder into the hollow formed by the join, and then curve the end of the soldering-iron by hammering, when, if the iron is hot, the solder will easily follow it round, the previous tinning facilitating matters. Test with water (leaving it in all night), and if all is right, clean up, polish, and put on one side. Another way of joining the two halves of the reservoir is given further on in the description of the weights.

We now have to make the arrangement for holding the reservoir. Fig. 21 gives a view of this without the ornamental arms. A is made of $\frac{1}{2}$ in. by $\frac{1}{8}$ in. flat brass wire. It should be of such a size that the reservoir will drop through it up to the join, but no further. File the ends, as shown in Fig. 22, while the wire is flat, and then bring them together and tin, lap, solder, and rivet, tapering the holes and filing off the ends of the rivets as shown. A tinman would be able to bend this part round nicely in his machine, or a casting could be turned up in the lathe.

B, Fig. 21, is now to be made of the $\frac{1}{2}$ in. by $\frac{1}{16}$ in. flat brass wire. Before bending it to fit the curve of the reservoir, make a hole in the centre large enough to admit the screw which projects from the bottom.

If the reservoir fits A well, it will be necessary to halve the two ends of B into A, soldering and riveting; but if it fits loosely this need not be done. In either case, taper the rivet holes and file off the ends flush. When you come to the fixing on of the arms, see that they do not come on any of the rivets in A.

A pattern must now be made for the arms. One of them is shown half size in Fig. 23 (see my next paper). Inasmuch as shades vary in size, it will be necessary to make a full-sized drawing in order to get the right position for the lugs by which the arms are attached to the shade-holder and A, Fig. 21. If you go to work haphazard, you will probably find that when the arms are riveted to the ring they will not allow the shade-holder to be fastened to them. As so much depends on the correctness of this drawing, and so many of the readers of WORK are amateurs, I think I cannot do better than commence my next paper with a description of the process.

HOW TO SHARPEN A PENCIL PROPERLY.

BY JAMES SCOTT.

"WHAT a sharp point!" I have often had remarked to me when my pencil has been travelling over a sheet of paper upon which probably I have been rough-sketching a piece of furniture in a workshop or warehouse. At first it may seem extremely superfluous to give a few hints how to properly sharpen a pencil, but I have frequently met with workmen who, although they say they *will* and certainly *do* have all their tools nicely sharpened, have, supported behind one of their ears, a pencil with a point the appearance of which almost makes me feel ill, and causes me to wonder how on earth men who are so used to working generally with sharp tools can progress favourably with such a piece of bluntness. It is far from improbable that many workmen of this class are gazing at this note, and to them, I am sure, this little mite of instruction will prove useful. It will come as handy, too, to the reader who, although he does not often find it necessary to use a pencil, now and again has a desire to trace or reproduce drawings given by the writers of this Magazine. Ninety per cent. of men—(we will not consider women, for in this matter a smile of intense pity always creeps over my features when I behold the excessive mutilation a woman inflicts upon a pencil)—ninety per cent of men hold the pencil in the air, with the end to be sharpened furthest from them, and slash away at it vigorously, and mentally curse the quality of the lead when they see piece after piece fall off, forgetting that after every stroke of the knife the pencil naturally springs upwards, its extreme point suddenly catching against the knife blade, and, consequently, standing a chance of being broken. In a draughtsman's office, almost the first lesson taught is how to properly sharpen a pencil, and it is no easy matter to the beginner to thoroughly accomplish this work, as I have personally experienced. There is more than one reason why a pencil point should be well sharpened: when the pencil is passing along outside the edge of a T-square or a mould, it should be close up against either of the latter, as the case may be; and when in ordinary drawing or tracing, a clear view should be obtained completely around

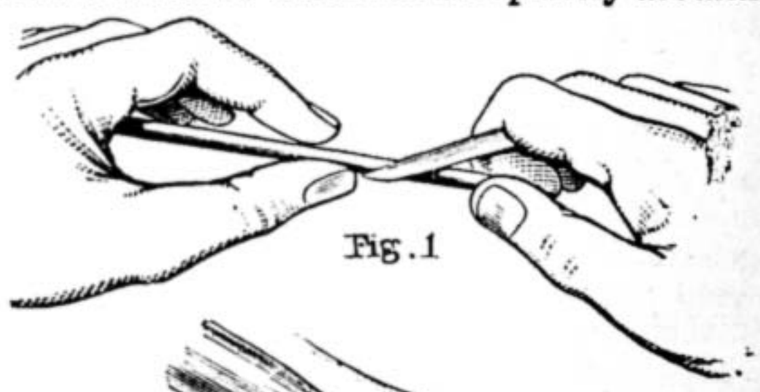

Fig. 1.

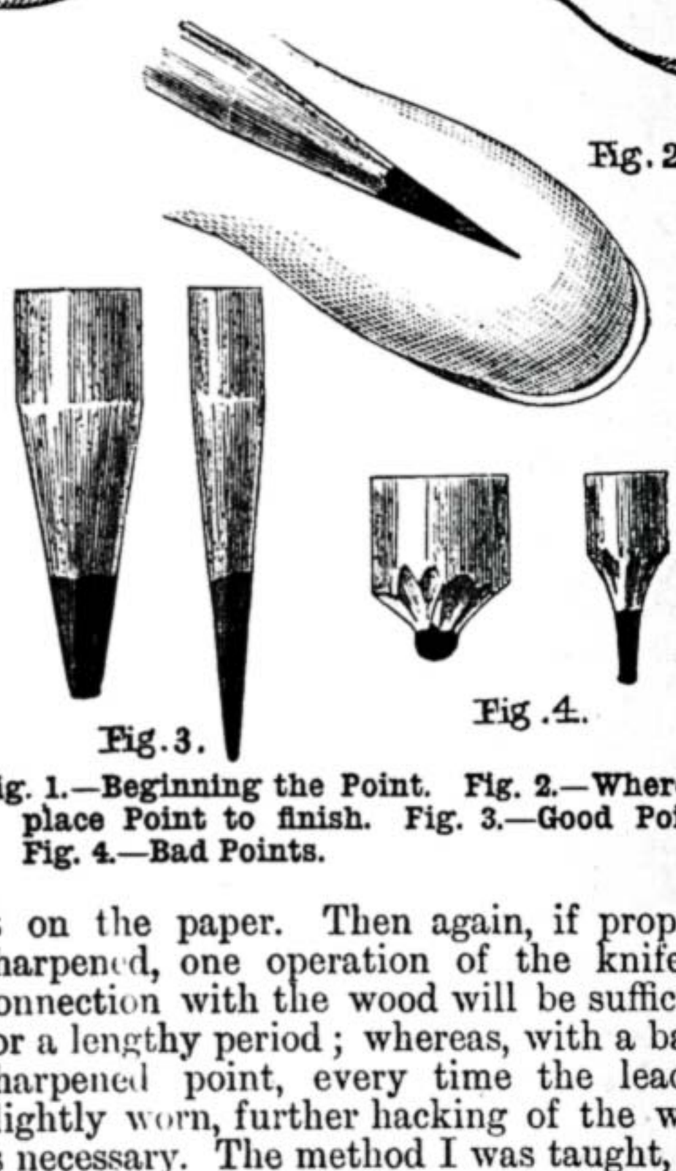

Fig. 2.

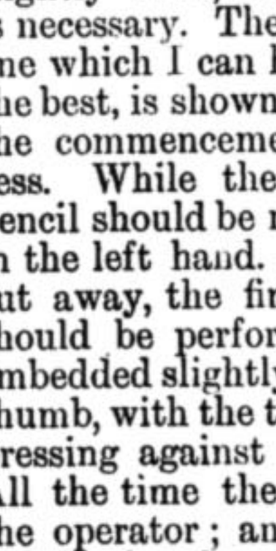

Fig. 3.

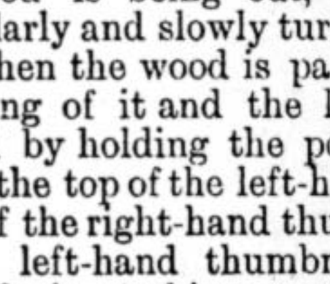

Fig. 4.

Fig. 1.—Beginning the Point. Fig. 2.—Where to place Point to finish. Fig. 3.—Good Points. Fig. 4.—Bad Points.

it on the paper. Then again, if properly sharpened, one operation of the knife in connection with the wood will be sufficient for a lengthy period; whereas, with a badly sharpened point, every time the lead is slightly worn, further hacking of the wood is necessary. The method I was taught, and one which I can honestly say I believe to be the best, is shown in Fig. 1, which represents the commencement of the sharpening process. While the wood is being cut, the pencil should be regularly and slowly turned in the left hand. When the wood is partly cut away, the finishing of it and the lead should be performed by holding the point embedded slightly in the top of the left-hand thumb, with the top of the right-hand thumb pressing against the left-hand thumbnail. All the time the knife is working *towards* the operator; and it will be clearly understood why, by such means, there is very little chance of any sudden concussion on the part of the pencil point against the knife blade, which chance is further lessened in the finishing process by the pencil point lying in the flesh of the thumb, and being slowly turned the while.

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THE ART AND PRACTICE OF SCENE PAINTING.

BY WILLIAM CORBOULD.

THE COLOURS—PREPARATION OF THE CANVAS.

The Colours.—I will first give a list of the colours most suitable for scene painting, and then proceed to describe their properties and the mode of blending some of them in order to obtain the different tints required.

Reds.
Damp lake.
Vermilion.
Chinese red.
Venetian red.

Blues.
Azure blue.
Celestial blue.
Indigo.

Yellows.
Yellow ochre.
Lemon yellow (pale).
Do. do. (deep).
Orange chrome (pale).
Orange chrome (deep).
Dutch pink.
Raw sienna.

Browns.
Brown lake.
Burnt sienna.
Vandyke brown.
Burnt umber.
Raw umber.

Whites.
Whiting.

Some medium size, with water, as explained further on, must be used when mixing the colours. I will now explain the properties of the colours enumerated, as some require different treatment to others in their mixing and using.

Damp Lake.—This, if good, should be of a bright crimson, rich and transparent; it will blend with any colour, forming hundreds of tints of great beauty. It is bought in a paste ready for use, requiring no preparation. It should be kept covered with water.

Vermilion.—Of this colour several kinds are manufactured; the best is crimson, which is the most durable. To prove whether or not it is good, rub a small portion on a piece of white paper; if adulterated it will change to a deep chrome yellow, if pure it will not change its colour. Being a heavy pigment, it would, if mixed with water only, for your palette box, sink to the bottom, forming a hard cake, and cause a deal of trouble. The best way is to mix it with sufficient size, so that when cold it would be a soft jelly. As the colour is thus held in solution, it will be much easier to work with.

Chinese Red.—This is a sort of mock vermilion, very serviceable, but not so bright as vermilion. This pigment is best mixed for the palette box in the same way as vermilion. It is specially useful for painting old red brick walls, chimney-stacks, tiles, etc.

Venetian Red.—This is a useful colour to the scenic artist, and may be mixed with water only for the palette box.

Azure Blue.—This is a beautiful colour when good, and is very useful; being a light pigment, it may be mixed into a paste with water for the palette box.

Celestial Blue.—This is a much darker colour than azure blue; it may be rubbed up with water for the palette box, and will form a variety of tints when blended with other colours. There is good and bad of this pigment; if a small portion is rubbed up with white it ought to be a bright blue, approaching azure in tint. It will make good greens when mixed with different yellows. It is a capital glazing colour, and good for shadows.

Indigo.—This is a good colour for various purposes. It is rather expensive, but a little goes a long way. A good substitute for it is celestial blue subdued with a very little vegetable black. A long range of greens may be got from indigo and yellows, particularly Dutch pink. It is also a good glazing colour. Being a light pigment, it may be ground up with water into paste for the palette box.

Yellow Ochre.—This is a good, useful pigment; it should be of a good bright tint. It may be mixed with water into a paste for the palette box. No other yellow is so good, when used with white, for large clouds in the sky, particularly for the high lights.

Lemon Yellow (pale or deep).—This colour will be found to be very useful for high lights and bright touches. A great variety of green tints are made by blending lemon yellow with other colours.

Orange Yellow.—This is another chrome, and may be got pale or deep, for uses similar to those for which the lemon chrome is applied. Both may be rubbed up with water for the palette box.

Dutch Pink.—This is a brownish-yellow tint, and is a most useful colour for greens, when mixed with blues chiefly. It is bought in lumps, and may be ground up with water for the palette box.

Raw Sienna.—This may be procured ready ground in water; it is similar to Dutch pink in colour, and useful for the same purposes.

Brown Lake.—This is a beautiful rich pigment, very useful to the scene painter. When in juxtaposition with greens it tends to take the rawness or cold look out of them, imparting a richness to the foreground. As it mixes kindly with all colours, its several uses are too various to describe. This pigment may also be rubbed or ground up with water for use.

Burnt Sienna.—This most useful colour is of a rich red brown; it may be purchased ground in water ready for use. It is a transparent colour, and will make good greens when used carefully, imparting a richness to foliage, especially autumnal tints. Raw sienna and orange chromes are useful for the same effects.

Vandyke Brown.—This colour may be purchased ground in water ready for use. It is a very valuable pigment.

Burnt Umber.—This is another colour that may be procured ground in water ready for use. It is useful for a variety of things, giving good stone-colour tints, when used with white and yellow ochre, for rocks, old buildings, etc.

Raw Umber.—This, too, may be ground up with water; it is lighter in tint than burnt umber, and is useful for similar purposes, as well as for clouds, when mixed with yellow ochre and white, which will be explained further on, when I come to sky painting.

There are, of course, other colours besides those described which are used by the scenic artist, but those which have been enumerated above are all that is required for the present.

Preparation of the Canvas.—This operation requires care, so that the canvas may have a good flat surface to work on. The best plan is to have a frame of the size of the cloth you are going to paint on. This can be made for temporary use with battens. It is most desirable not to allow the canvas to touch the wall or anything behind, except at the extreme sides, top, and bottom, because in the painting whatever the brush comes in contact with leaves a mark if the artist is not very careful, which spoils the work when dry. It would not matter if the wall were plastered and thus presented a flat surface, but a brick wall would be very objectionable. Supposing that the battens which are to be used are 3 in. by 2 in., the artist should place the two-inch side to the wall, which would keep the canvas three inches off the wall. If the stretching is not done well the canvas will touch the wall in the centre. In stretching, take up one corner and tack it to the top of the frame; next take up and tack the other top corner, and then the top centre. The cloth is now hanging down from the top, and the artist must now tack the two bottom corners, and then the bottom centre, and lastly, the side centres. Having done this, pull the cloth as tight as you can. The cloth is now tacked at the four corners and centres; proceed to tack it all round by dividing the centres and corners, stretching the cloth tightly at every tack, until the tacks are about six inches apart all round. The cloth will then be ready for priming.

I have shown the way to mix the priming in page 642, when writing about whiting. This priming of the canvas must be well done by crossing and recrossing the brush, rubbing it well into the cloth; not a square inch should be missed in any part, and great care should be taken in this part of the work, so that when dry the cloth shall present a broad flat surface, as tight as a drumhead.

When joining your canvas, always put the selvedges together, and have them over-sewn. Supposing your cloth to be 15 feet high and 18 feet long—or, in other words, six yards by five; as the canvas is two yards wide, it would take fifteen yards of stuff to make the cloth. Two lengths of six yards each must first be sewn together. The piece that is left, which is three yards long, must be cut through the length. The two pieces thus obtained are put together so that the selvedges are on one and the same side. Join the selvedge of this piece to one of the selvedges of the large piece. The cloth is now ready for the frame. In hanging up the cloth, keep the part where the two small pieces were put on at the bottom, as the extra seam that it has been necessary to make would not show in the foreground painting, but it might in the sky. Of course, if the cloth was eighteen feet high the three lengths would go together simply enough. I have explained this in case it should be necessary to join in the way described.

To repair a cloth that has a hole in it the patching must be done before priming in this way:—Cut a piece of canvas a little larger than the hole to be repaired, have some thin glue, and glue the piece to be put on all over; have a piece of flat board held behind the hole, place the piece over the hole, and rub it down with a damp piece of rag or canvas. If done neatly, it will not be seen when the painting is finished.

OUR GUIDE TO GOOD THINGS.

*** *Patentees, manufacturers, and dealers generally are requested to send prospectuses, bills, etc., of their specialities in tools, machinery, and workshop appliances to the Editor of WORK for notice in "Our Guide to Good Things." It is desirable that specimens should be sent for examination and testing in all cases when this can be done without inconvenience. Specimens thus received will be returned at the earliest opportunity. It must be understood that everything which is noticed, is noticed on its merits only, and that, as it is in the power of any one who has a useful article for sale to obtain mention of it in this department of WORK without charge, the notices given partake in no way of the nature of advertisements.*

111.—THE "RIDSDALE" FIRELIGHTER.

THE "Ridsdale" Firelighter is a handy contrivance that has been recently patented and introduced to the public by the Ridsdale Patent

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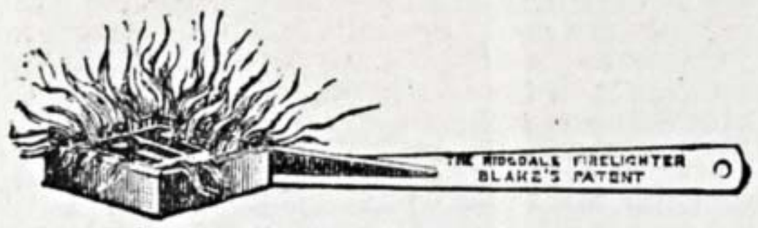
Firelighter Company, and is manufactured by them at Crewkerne, Somerset, and sold by them, and will be sold in due time by all ironmongers and oilmen on account of its obvious utility. As may be seen from the illustration, it consists of a diamond-shaped cast-iron box, 3¾ in. long and 2¾ in. wide, with a handle 8½ in. long attached, having a hole at the end by which it may be hung up against the wall. The depth of the box externally is 1 in., and at the top are the letters R F, forming a kind of grating, under which is a packing of asbestos. To use the Lighter, paraffin oil must be poured on the asbestos until it will take in no more; a lighted match must then be applied, and the lighter passed between the bars of the grate and allowed to rest on the bottom. Coal must then be placed



The "Ridsdale" Firelighter.

lightly and loosely around and over the lighter, which, being of cast iron, cannot be injured by the flaming paraffin or burning coal. When the oil is burnt out, the Lighter should be withdrawn, to be refilled with oil and used again when wanted. A fire of coal only, without sticks or paper, will be well alight in a quarter of an hour, and in much less time if sticks are used. Boiling or frying may be effected by its aid, if the Lighter, charged with oil and alight, be placed between the bars of the grate and the kettle or frying pan placed over it. Bakers, it is said, may use it as a lamp for lighting up their ovens at the time of filling and drawing. It is economical in its use, for ten or twelve fires may be lighted without wood or paper for a penny, and doubtless, considering the cost of bundle-wood, many will buy it and use it for this reason. Bachelors and others living alone, or with a chum in chambers, will find it most valuable, as it saves the trouble inseparable from laying in a fire. It is ready for use in a few seconds, and is safe, reliable, cleanly in use, and free from smell.

112.—Elementary Chemistry for Science Schools and Classes.

I have had occasion to speak before of the excellent series of practical illustrated manuals specially prepared for the use of the students of the Polytechnic Institute, Regent Street, London, W., but designed to meet the wants of all students in Science and Art Schools, and to satisfy the requirements of the new Syllabus issued by the Science and Art Department, South Kensington. The preceding volumes of the series, which are noticed in page 74 of this Magazine, as well as the volume now under consideration, are published by Messrs. Cassell and Company, Limited, La Belle Sauvage, Ludgate Hill, London, E.C. The author is Mr. Robert Avey Ward, Lecturer at the Polytechnic, Cooper's Grammar School, etc. etc., and its price is 1s. 6d. Its contents are arranged in twenty-three chapters, commencing with an exposition of the elements of which all matter, be it what it may, is composed, their mechanical mixtures and chemical compounds, and ending with a review of the known metals and their alloys. To go through the chapters seriatim is impossible through want of space, but after showing that matter is practically indestructible, and that what we regard as its destruction is in reality nothing more than change of form, or resolution into its original elements or their combinations, the writer proceeds to explain the symbols and formulæ used in chemistry, and the modes of chemical action, and then to deal with the properties of oxygen and ozone, hydrogen, water, nitrogen, the air, carbon and its compounds and oxides, and sulphur and its oxides. Naturally this is but a very rapid and imperfect summary of the well-ordered contents of the volume, and all that can be done in addition to this is to recommend in the strongest terms this excellent treatise, which is most clearly and tersely written, and with whose aid no intelligent student can fail to acquire sufficient knowledge of chemistry to pass any elementary examination, and even more. The Editor.

SHOP:

A Corner for Those who Want to Talk It.

*** *In consequence of the great pressure upon the "Shop" columns of* Work, *contributors are requested to be brief and concise in all future questions and replies.*

In answering any of the "Questions submitted to Correspondents," or in referring to anything that has appeared in "Shop," writers are requested to refer to the number and page of number of Work *in which the subject under consideration appeared, and to give the heading of the paragraph to which reference is made, and the initials and place of residence, or the nom-de-plume, of the writer by whom the question has been asked or to whom a reply has been already given. Answers cannot be given to questions which do not bear on subjects that fairly come within the scope of the Magazine.*

I.—Letters from Correspondents.

Formulæ.—Brass writes:—"I see A. R. (*Scorrier*) writes in 'Shop,' No. 89, page 599, complaining of the use of formulæ in replies to questions which are submitted by correspondents. At first sight, one is inclined to imagine A. R. has reasonable grounds for complaint, but on giving the matter a little thought, a few ideas occur to me showing good reasons why formulæ should be used. There can be no question that the primary object of Work is for educating its readers in the theory and practice of all kinds of mechanical labour, and the best way of doing so is by using methods which will help to impress upon the minds of readers the manner by which various results are attained. Thus, formulæ are of great benefit in helping us to remember how to solve many and complex questions in mechanics and other sciences, many problems of which it would be almost impossible to work out without their aid. Then, if it is as A. R. says, 'questions so answered may be very clear to some, and puzzling to others,' some correspondents may, perhaps, not understand arithmetic beyond simple multiplication and division; how is anyone to know to what extent readers have such knowledge? If readers were to be replied to as A. R. would like, how would questions be answered such as the one asked by Nero on 'The flow of water through syphons' (see page 503), and many others which are answered similarly from time to time? When complicated formulæ as the above-mentioned are given in reply to a correspondent and he cannot understand it, it is generally the correspondent's own fault that he gets such formulæ for an answer. The fault lies in this: if the reader, instead of asking for the rule or method for solving a question, would state the question itself that he wants to be solved, he would then get for reply an answer which he could understand; and not a rule in which the use of terms or arithmetic are used, the explanation of which would probably take up all the columns allotted to 'Shop,' the space of which is very much taxed as it is. Then supposing that there was sufficient space in 'Shop' to allow of questions being dealt with as A. R. suggests, it must be remembered that those who have to answer the questions have not always so much time on their hands that they would be inclined to go into the elementary details of any subject. The formulæ used by me, to which A. R. objects, is of the simplest character, and with the explanation which is given with it, could, I think, be readily understood by anyone. It would not have been a difficult matter to have dispensed with the formula, but it would have necessitated the reply being about twice the length. Why the question at the end was asked, was that if any certain point could not be comprehended (we all do not read Work through the same pair of eyes), the correspondent could point out that particular portion and have it explained further."

Draping an Iron Bedstead.—J. H. B. (*Pendleton*) writes:—"I read the article on the above with great interest, and now send you sketches of a simpler plan which, though not so picturesque perhaps, will be found more easy to construct for anyone who is not very cute at joinering. Fig. 1 shows the

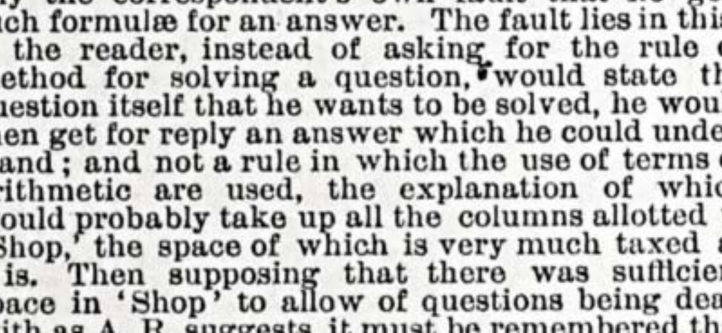


Fig. 1. Fig. 2. Fig. 3.

Iron Bedstead Hangings.

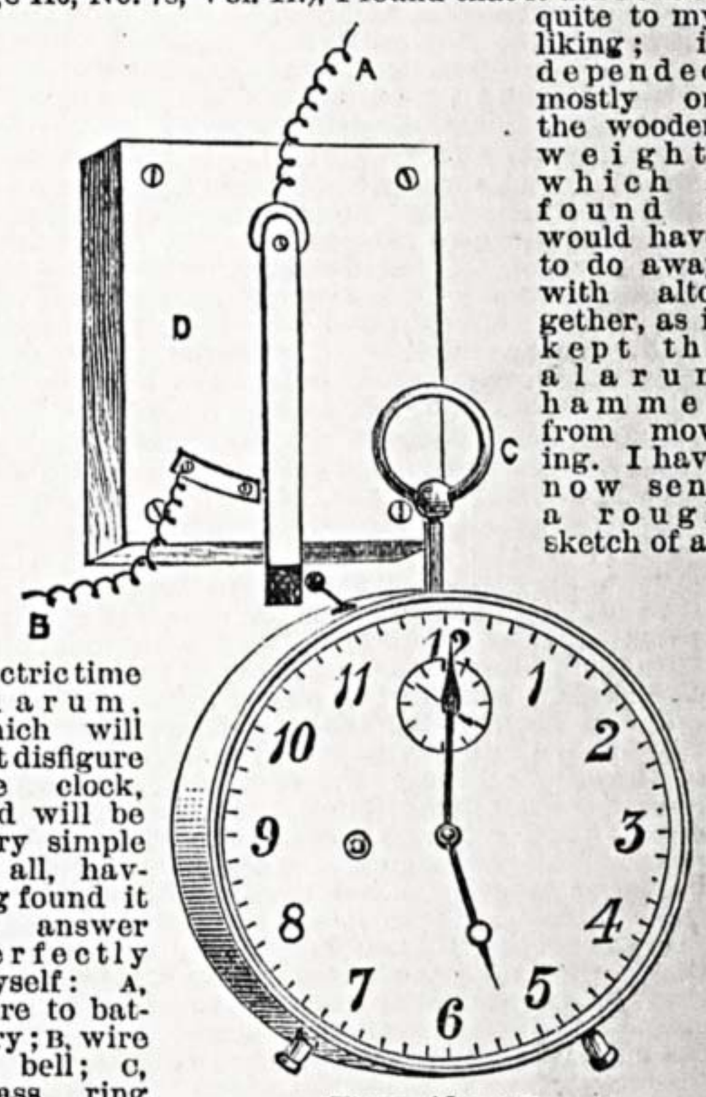
arrangement without the curtain. It is merely a pole fastened horizontally to the wall (Fig. 3). Fig. 2 shows it with the curtain over it. If it (the curtain) be box-pleated along the top, there will be quite enough to meet at the back and keep out the draught."

Nesting Baskets for Canary Breeding.—F. H. (*London, S.W.*) writes:—"Here is a form I have used with success; it is made of small penny baskets, nailed on to a piece of wood, and fixed to a larger piece at right angles, and a perch is fixed at the side so that the birds may feed the young. The basket is fixed about ¾ in. away from the upright

Nesting Baskets for Canary Breeding.

piece, so that the droppings of the young may fall away from the nest all round."

Time Alarum.—H. F. S. (*Hammersmith*) writes:—"Having followed up the plan of L. Pendred (see page 416, No. 78, Vol. II.), I found that it did not act quite to my liking; it depended mostly on the wooden weight, which I found I would have to do away with altogether, as it kept the alarum hammer from moving. I have now sent a rough sketch of an



Time Alarum.

electric time alarum, which will not disfigure the clock, and will be very simple to all, having found it to answer perfectly myself: A, wire to battery; B, wire to bell; C, brass ring to unscrew to remove gong; D, box to be made in width to suit clock, and screwed to wall; the clock can be removed at pleasure. When the alarum has been wound up and set to time wanted, the hammer strikes the switch bar enough to join the circuit, and continues ringing the bell till someone gets up and stops it."

II.—Questions Answered by Editor and Staff.

Bright Copper Deposit.—A. H. D. (*Birmingham*).—I have frequently deposited a thin film of copper on a burnished surface without impairing the brilliance of the burnish to any great extent. This has been done in an alkaline solution of copper, and working at a temperature of about 160 Fah. Thick deposits of copper from any solution must have a dull appearance, because the copper is deposited in small grains massed together, but bright deposits of copper may be got on *highly polished* brass or any other metal, if a thin film only will suffice. This coat will soon discolour on exposure to the air, and will even lose its lustre whilst drying unless kept covered with hot sawdust. The coppered article should be lacquered whilst hot from the drying oven, to preserve its lustre. The surface of the article must be previously highly polished to ensure success.—G. E. B.

Nickel-Plating Bicycle.—G. F. M. (*Bristol*).—You are about to take a high flight in nickel-plating by attempting to re-nickel the worn parts of your bicycle, and this is a job beyond the province of an amateur. It requires more than ordinary skill born of experience, and is best relegated to the professional plater. The greater part of your questions relative to this job will find complete answers in the replies to J. C. J. (*Hepworth*), on page 551, and M. R. (*Huddersfield*), on page 552, Vol. II. of Work. You will probably require three Bunsen cells in series, and these should be large, holding over one gallon of liquid. Vessels of zinc or of tin are unsuitable as plating vats. One pound of the double

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sulphate of nickel and ammonia dissolved in one gallon of hot rain-water and allowed to cool, or two pounds in three gallons of water, will both make good depositing solutions of nickel. You should practise for a few weeks on other smaller things before attempting to plate your bicycle.—G. E. B.

Half-Plate Camera.—A. B. C.—If A. B. C. procures the Index to the first volume of WORK, he will find reference to working diagrams for making a camera with a reversible back. The size given is for 8½ in. by 6½ in. With a very little ingenuity he will be able to adapt it to the size he requires, the design being the same in both cases. A little lighter material is, of course, permissible.—D.

Ornamental Turning.—F. P. (*Andover*).—You are accustomed to wood turning, and wish now to do spherical and plain fluting. For fluting you will require a slide-rest, a division plate and index, a drilling spindle and an overhead motion; also you would want fluting stops. For spherical fluting you would require either a dome-chuck or a spherical rest in addition to the foregoing. Now, you see all this apparatus will be very expensive, and if you make it, it will require very good workmanship. Also it would be a pity to add very valuable apparatus to an indifferent lathe. Probably your best plan would be to look out for a second-hand ornamental turning lathe, and you may, perhaps, get one with the above apparatus at from £50 to £100. Suppose, however, you are satisfied with your present lathe, and wish to add the required apparatus yourself, then try to pick up a slide-rest, say £4; driller with half dozen drills, say £2; your pulley divided, or brass plate fitted to it containing three rows of holes, also index spring and peg, say £2; you must then make the overhead motion and fluting stops. A dome-chuck costs about £10, and a spherical rest £50; the best, when new, cost £15 and £75.—F. A. M.

Lathe Mandrel.—W. E. P. (*Manchester*).—Papers on mandrels by me are in hand, which will, perhaps, help you. Your brass step pulley may come in, but the ½ in. spindle is not worth making a mandrel of. If you are determined to use it, you might have a ¼ in. screw cut on one end, with a shoulder for chucks; and have two necks turned in it for the bearings. ½ in. extreme diameter is so very small, you would only have a lathe fit for turning chess-men.—F. A. M.

Acorn and Cone Work.—JACK will find some hints on this work in an answer to F.H., in WORK, Vol. I., p. 685, No. 43.—M. M.

Watch Matters.—LEO.—(1) Mainsprings. To gauge the strength of mainsprings, I use a Jacot pivot gauge, and find it answers the purpose well; it is sold by the tool shops for about 1s.; it is two pieces of steel about 1½ in. long, held together by two short cross-pieces and having scales one each side; at one end the two pieces meet; at the other they are about $\frac{1}{50}$ in. apart, and being 1½ in. long, this gives a fair fine gauge. To use it, pass the end of the spring through the open end, and gently let it drop, and note what figure it is against, then test the new one same way. (2) In ordering springs, you must have a mainspring gauge, or send the barrel if you have the gauge; see that the old piece of spring is the right height; if so, gauge it for height by fitting it in the notches till it fits one tight, take number of it, and then take the barrel and fit it over or in the rings or countersinks that are turned on the flat sides of the gauge; take the number of the sink it fits in, and order the spring, you will then find it is the proper strength for the watch. There are two mainspring gauges, one for the English watches, and one for Geneve. (3) Geneve mainsprings will not do for English lever watches. (4) A good spring when wound up hard several times in the winder, and then let out, should keep its form and size, but a soft bad spring after a few windings will not open out as it should; the general finish too is indifferent, and the price is also different; order at a good shop and pay a good price, and, no doubt, you will get a good article. (5) You cannot alter a spring, or, if you could, it would be useless. (6) Punches for riveting, etc. "Boley's" make in boxes, twenty-one punches, 3s. 2d.; thirty-two punches, 4s. 6d.; forty punches, 6s.; and fifty, 7s. 6d. You will find the box of forty will be a good assortment and will do all general work. Punches for hole closing, "Boley's" to 3m., per dozen, 13s.; to 6m., per dozen, 14s.; to 9m., 17s.; or in sets of six, 6s. 6d.; twelve, 13s.; sixteen, 18s.; these prices I take from Haswell and Son's list, 49 and 50, Spencer Street, Clerkenwell. There is a barrel-hole closing tool which will close any hole from a large barrel to a small fourth-wheel hole, price 22s. 6d.; also another riveting stake and punches complete at 16s. 6d.; these two I take from Grimshaw & Co.'s list, 35, Goswell Road, Clerkenwell. (7) Dooming punches are used by case makers for making the shaped cases. (8) The Hammond wheel I know nothing of, so cannot say, and I have not Cohen's list to judge from. (9) I use small emery wheels. I have several down to 1½ in. diameter and smaller, and any thickness down to about ⅛ in., also different coarseness and fineness. I obtained these also from Grimshaw & Co.; write and get their list, enclosing, say, six stamps, and you will have a list of nearly everything you will want and a great deal you will not want. I trust these remarks will be of use to you, and that you will obtain what you require.—A. B. C.

Wooden Printing Press.—J. A. G. (*Sunderland*).—As you are doubtless aware, there is many a slip 'twixt the cup and the lip, and many an awkward hiatus between promises made in all good faith and the fulfilment thereof. It was found necessary to return the manuscript of "A Wooden Printing Press" to its author for compression and division into parts, as it was too long to appear in a single number. With regard to replies in "Shop," they are still on the increase, but everything that can be done to relieve the congestion is done.—ED.

Dialyte Telescope.—AM ASTRO asks for instruction for making a telescope of the Dialyte form in "Shop," 8 in. or 10 in. Also cost of same with diagrams of instrument, if possible. I am afraid this is rather a large order for "Shop," but I will do my best. I have never made an instrument of this form, though I am fortunate to possess nearly all the literature there is on it, and will give AM ASTRO the benefit of it. On paper it is a most simple instrument to construct, in practice it is somewhat difficult. One of our principal manufacturing opticians said a few years ago that, being desirous of placing such an instrument on the market, he made the attempt; but, though he had ample appliances, he failed to produce one to his satisfaction. The principal advantages are that, as the correcting lenses are placed at a distance from the front O.G. about one-half of its focal length, they need not be more than one-half the diameter of the O.G., which, consequently, makes a great difference in cost; and secondly, that by slightly shifting them experimentally, the best position may be found for correcting spherical aberration. The great difficulty is that of properly centring the three lenses—as if they are not accurately centred, they will be utterly useless. The following combination gives good results:—Object lens, 8½ in. in diameter; white crown equi-convex, 130 in.; radius of curvature, 10 ft. focus; corrector, 4½ in.

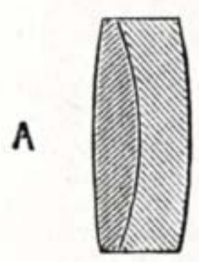

Fig. 1.

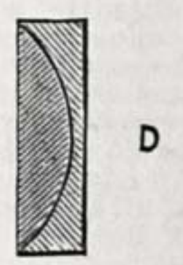

Fig. 2.

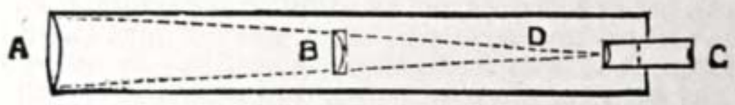

Fig. 3

Dialyte Telescope. Fig. 1.—A, Crown Glass; B, Flint. Fig. 2.—C, Dense Flint; D, Plate Glass. Fig. 3.—Section of Dialyte Telescope—A, O.G. Plano Convex; B, Correctors, Plano Convex and Plano Concave, half diameter of O.G.; C, Eye-Piece; D, Cone of Light.

diameter; crown double convex, 12·5 in. and 130 in.; 4½ in. flint; a miniscus concave 12·5 in., the two faces 12·5 together; convex, 130 in. These may be cemented as in Fig. 1, and are placed from the O.G. about one-half of its focus. If AM ASTRO considers the cost of such an instrument too great as an experiment, I will give him another formula:—Object glass, 4½ in. diameter, focus, 60 in.; double convex radi, 24 in. and 240 in.; correctors, 2½ in. diameter; plano concave, 3½ in. radius of double dense flint; plano concave, 3½ in. radius of plate glass; the concave and convex faces together, Fig. 2. It is sometimes an advantage not to cement them, as the best performance is given when they are slightly separated. The compound corrector should be mounted in a separate tube, so as to allow of adjustment. In Fig. 3 is given a section of the instrument. The eye-piece is an ordinary one. The Editor has in hand a short article on the building of eye-pieces which, no doubt, will in due course appear, and will supply the rules for constructing any given power. The mere mechanical work I must leave, as it would be too long to give such details in "Shop." Now as to cost, I cannot give any estimate that could be valuable, but accurate information can be obtained from any of the practical opticians who advertise in any of the scientific papers. One other word; in my judgment the corrector should be slightly larger than one-half of the clear aperture of the O.G., as it may require to be placed a little less than one-half the focal length from the O.G. If so, it cannot take in the whole of the cone of light; consequently, a portion of light will be lost.—O. B.

Gilding Coin.—R. H. (*Accrington*).—You can gild the coin yourself, but an outfit of some sort must be obtained. As you seem to know nothing of gilding, I think a new arrangement, called "The Practical Electro-Plating and Gilding Outfit," will suit you best. The price is 21s. This includes Bunsen battery, gold, silver, copper solutions, scratch-brush, sawdust, etc. etc., and these are enclosed in a box, along with directions for use. Plucknett & Co., 29, Poland Street, London, W., are agents, and will reply to any inquiry for further particulars. If you do not intend to go in for anything like that, you might send it to some electro-gilder. Pairpoint & Sons, 7, Green Street, Leicester Square, are the best firm I know. There is *no* process whereby merely painting powder on will stand wear.—H. S. G.

Lathes in WORK.—SNOBBY.—Several articles on making lathes have appeared in WORK by SELF-HELPER, entitled "Lathes for Everybody." You should get an Index to Vol. I., post free for 1½d., from Cassell & Co., and you will then be able to see what numbers you should purchase.

Wire Thread Fret Saws.—D. D. (*Aberdeen*).—I mentioned Messrs. Moseley (not Mosley) and Son, 323, High Holborn, London, W.C., as a firm from whom you would be most likely to obtain the wire thread fret saws. It is, as I call it, an "old-established" firm, and still flourishing. Why you have not received any reply, as you state, to your two letters is more than I can say. When I myself give an address, you may rest satisfied that the address is correctly given. Your letter, which bears initials only by way of signature, and no name or address beyond Aberdeen, has been sent on to Messrs. Moseley and Son, and they, doubtless, will be able to explain why your letters have not been answered if they have received them. At the same time, if readers of WORK write to addresses given, and do not get replies, they cannot reasonably expect me to expend both time and trouble in ferreting out the reason. In the majority of cases in which I have done so, I have found that the non-receipt of a reply is to be attributed to some shortcoming on the part of the writer. Possibly, as in your letter to me, you have omitted to give your name and full address.

Cabinet Photo. Frame.—P. W. (*Leeds*).—I note that you complain of the ill effect of the narrow margin of the cabinet photo. frame given in page 533 of this volume. The pattern, as you say, certainly looks very well in the page, but as I have not seen it cut, I cannot speak to its appearance in this condition. My plan of finishing it would be to back the outer portion to which the folding-doors are attached with a wood contrasting with the fret-cut wood in colour, forming a rebate wherein to set the photo., which must itself have a backing. If to stand on a table, I should then have placed it on a miniature easel. If hung against a wall, I should certainly have placed the cut panel in its entirety in an external frame, the fretwork thus serving as a sort of mount for the photo.

Rubber Oddments.—RUBBER could not make a bicycle tyre unless he worked in a factory where rubber tyres are made. His plan is to sell his rubber to a manufacturer and get equivalent in a new tyre.—A. S. P.

Fresco Cement.—A. G. A. (*Sand Pits*).—I could place at your service any part of the practice or compounds used by the celebrated French fresco artist, M. Borromée, did I know what you want. If you mean by "a permanent cement called fresco cement," the basis of the painting upon, or mixed with, which colours are applied, there are several such compounds believed to be permanent, but each prepared for different exigencies of the work. Permanent fresco painting is a difficult matter, requiring skill and experience from the first scraping of the stone wall, through the necessary two or three coats of "anti-absorbent" mixtures, and then in the final waxing—all irrespective of the artistic aspect of the work.—DECORATOR.

Indiarubber Process.—W. H. R. (*Birmingham*).—The process consists in coating one side of each piece of cloth with a solution of indiarubber in naphtha, placing the coated surfaces together whilst still wet, and passing the whole between steam-heated cylinders, to secure contact and evaporate the solvent.—QUI VIVE.

Stamp Mounting—Prices—Level.—H. O. B. (*Peckham, S.E.*).—You might help readers by making this known gratuitously through Section I. of "Shop." Also make known the addresses of any dealers of articles by going to whom money can be saved. Any carpenter will make you a level.

Electrical Resistance.—DENNY.—First abandon the idea of a battery being made to give a certain number of ampères at the terminals under all circumstances. The current given there will depend upon the voltage of the battery, divided by all the resistances in the circuit; the internal resistance of the battery cells as well as the external resistances of every connector and conductor in the outer circuit. Suppose we have a battery with an E.M.F. of 4 volts and an internal resistance of 1 ohm. Then, 4 volts divided by 1 ohm will equal four ampères, and this will be the volume of current obtainable at the terminals at the moment of closing the circuit—that is, of connecting the zinc at one end with the copper at the other end of the battery. But the internal resistance of the cells will rise at once, and the current will fall when the circuit is closed. When a resistance of 1 ohm is put in the outer circuit, the volume of current will then be $\frac{4}{2} = 2$ ampères. Part of the current is absorbed in heating the conductors, but less current is generated in the cells with a high resistance in the circuit.—G. E. B.

Internal Resistance of Battery Cells.—DENNY.—If I put it to you in the following manner, I think you will see clearly that the resistance of the battery is one-fourth instead of one-half. Suppose the internal resistance of each cell to be 1 ohm, then four cells placed in series will have an internal resistance of 4 ohms. If we now take off two of the cells, the remaining two will have a resistance of only 2 ohms, since one-half the number of cells will have only one-half the resistance of four cells, and $\frac{4}{2} = 2$. If now we place the two halves of the battery side by side and connect the ends together so as to form a battery of two rows of cells with two cells in series in a row, we shall provide two paths for the current instead of one path, and as this will halve the internal resistance of the cells, the total resistance will be $\frac{2}{2} = 1$ ohm—that is, one-fourth the resistance of four cells placed in series.—G. E. B.

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Employment in Electric Engineering Firms.—A. B. C. (*Malta*).—As you have had ten years' practical training in the use and repair of electrical instruments, you would stand a good chance of obtaining employment in an electrical engineering firm making a speciality of electric light installations. Your first-class certificates of ability and character would secure you favourable attention from the heads of such firms, but you must be prepared to wait for a vacancy after you have made application. A gentleman who does business in this line says you must also be prepared to begin at the bottom and *work* your way up to the higher branches of the profession. You might make written application to some of the firms mentioned in the Electrician Trades Directory, 1891 edition, published at 5s. 6d. by the *Electrician* Publishing Company, 1, Salisbury Court, Fleet Street, London, E.C.—G. E. B.

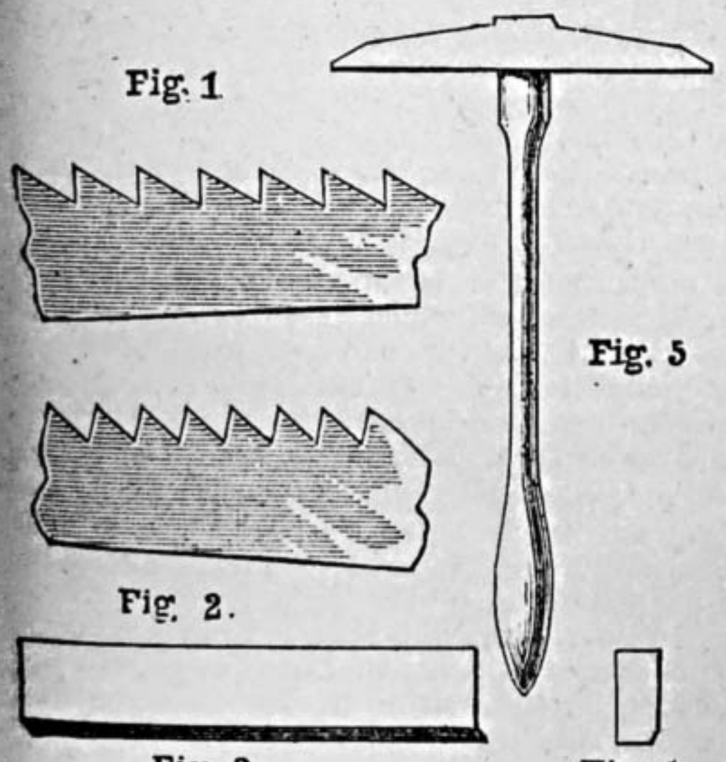
Dog Cart.—F. F. (*Cardiff*).—An article appeared in WORK, No. 19, entitled "The Battlesden Cart," which you might accommodate to your requirements.

Chiffonnier.—F. E. (*Bagnall*).—Thank you for your design "drawn from one at home" for DUSTY-POOL.

Globe Maps.—R. J. (*Glasgow*).—Messrs. G. Philip & Son, Map Publishers, 32, Fleet Street, London, E.C., are pretty sure to sell what you require—namely, maps to recover an 18-inch globe.

Compo.—F. F. F.—As to the ornamental pomatum-pot top, if a few hints are of any use, we give them. The substance appears to be prepared in a paste, and to undergo thorough grinding, mixing, and probably then is pressed into metal moulds, as "lincrusta" is made. Its component parts appear to be gypsum—finest plaster—a little indiarubber, linseed-oil, and probably some shellac. The oxidisation of the oil after the moulding process would cause it to harden. It is not of a china or clay nature. Notice that it is a patented thing.—F. P.

Hand Saws.—AMATEUR.—You say it is awkward to get a competent man to sharpen your saws. I experience this often, as saws that have been sharpened by a travelling man on a Friday have been sent some two or three miles to me on the following Monday to be resharpened. You wish to know what tooth is best for ripping, and what kind of shape is best for cross-cutting. To make it very clear, I give rough sketches of teeth for both ripping and cross-cutting. Fig. 1 will be found the most suitable for ripping, and when sharpening, shoot the file almost straight across the teeth, which will give the front of teeth but little bevel. It will be seen that for ripping, the teeth for general work are a little coarser than for cross-cutting. Teeth, Fig. 2, are suitable for cross-cutting; it will be seen that the front of these teeth are not upright, as you asked in your letter, but they lean back a little; this is to prevent the saw pitching, as we term it. Again, the front of these teeth should have a deal more bevel than the rip-saw teeth, for the following reasons. It will give the teeth a keener edge to cut across the grain or the fibres of the wood, and in cutting across very soft wood the bevel should be greater than for cutting across hard wood. In reference to patent saw sets, parties from time to time have brought patent saw sets to me asking my opinion of them, and in all cases I disapproved of them. The following will be the best and quickest way to set your hand saws. Get a piece of steel 6 or 8 in. long, 1½ in. or 2 in. wide, and bevel as in Figs. 3 and 4; put it in a vice, then place the



Hand Saws. Fig. 1.—Ripping Teeth. Fig. 2.—Cross-Cutting Teeth. Fig. 3.—Setting Anvil. Fig. 4.—Steel Bevel. Fig. 5.—Setting Hammer.

saw flat on it, letting the teeth project over the bevel. If setting a rip saw, do not let the teeth project so far over as when setting teeth for cross-cutting, as less set is required for ripping. When the saw is in position for setting, take a hammer about 5 or 6 in. long, as in Fig. 5, and strike the point of teeth with it, holding the handle of hammer from you if the points of teeth are toward your left hand; if toward the right hand, keep handle of hammer toward you, striking in each case every alternate tooth.—A. R.

Chiffonnier.—J. C. B. (*Glasgow*).—This article can hardly be called a chiffonnier; the term "bookcase" would be more appropriate. The height you mention—8 ft. 6 in.—is very excessive, and I should advise you before adopting it to roughly indicate dimensions upon a wall. It will be best to make the job in two carcases, screwed together at A. Scan index and back numbers of WORK for methods of construction. Instead of carrying the internal top break continuously to bottom of job, I have introduced in bottom carcase an external break, as presenting a much better appearance. To save labour

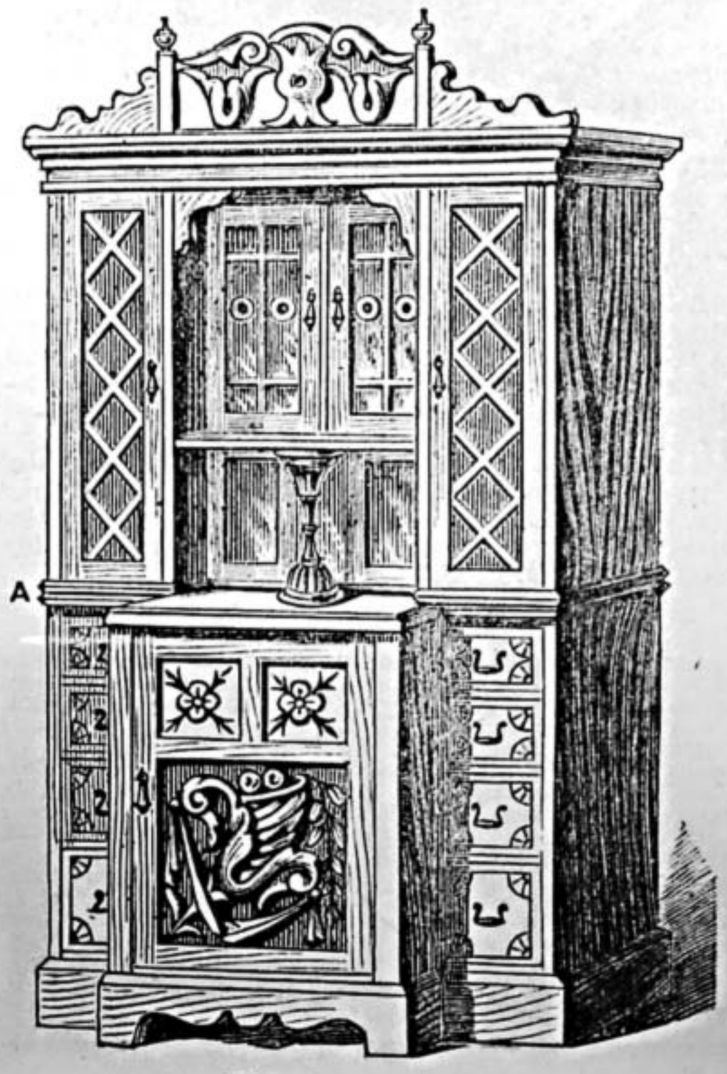


Fig. 1

Fig. 2.

Fig. 3.

Fig. 1.—Chiffonnier or Bookcase. Fig. 2.—Section of Top Doors. Fig. 3.—Pilaster at each Side of Bottom Cupboard.

by mitreing up a break cornice (six mitres), I have intended that a straight one (two mitres) should fit in the usual manner over a four-cornered top board joined to top of upper carcase. The canopy thus formed will prove effective. The small shelf is not intended for use—it is merely a front continuation of top cupboard bottom board, to break the plain appearance of job. Underneath it you could have a narrow fixed upright board, with a clear space behind it and the two doors forming one cupboard, and on the front of it glued the halves of a turned ornament, each reversed; the top doors to contain fret and plain glass, but, of course, you may substitute carvings. A shaped plinth is preferable. Face up bottom middle cupboard sides as at B (Fig. 3). I prefer this way. If you wish, lessen the depth from back to front of top carcase. Do not have too large a shaped piece in each corner under cornice and frieze, as doors then will not open far.—J. S.

Bismarck Brown, etc.—FIRST AND LAST.—For large quantities of goods near Bolton, write J. Williamson & Son, Lion Varnish Works, Lancaster. For same of Bismarck brown and aniline dyes, write direct to Judson's, the well-known vendors of many small things of that nature. Yes, there are two kinds of aniline black; one will only dissolve in spirits, and the other will in water. When ordering, state for spirit solution, if such is desired.—F. P.

Gilding.—W. H. A. (*Canterbury*).—Re-gilding a French timepiece is a matter best given to a local silversmith. Articles upon these processes appear in WORK, Vol. I. For fretwork and frame material in large quantities, apply to Melhuish & Sons, Fetter Lane, E.C., and H. Morell, Great St. Andrew Street, W.C., respectively.—F. P.

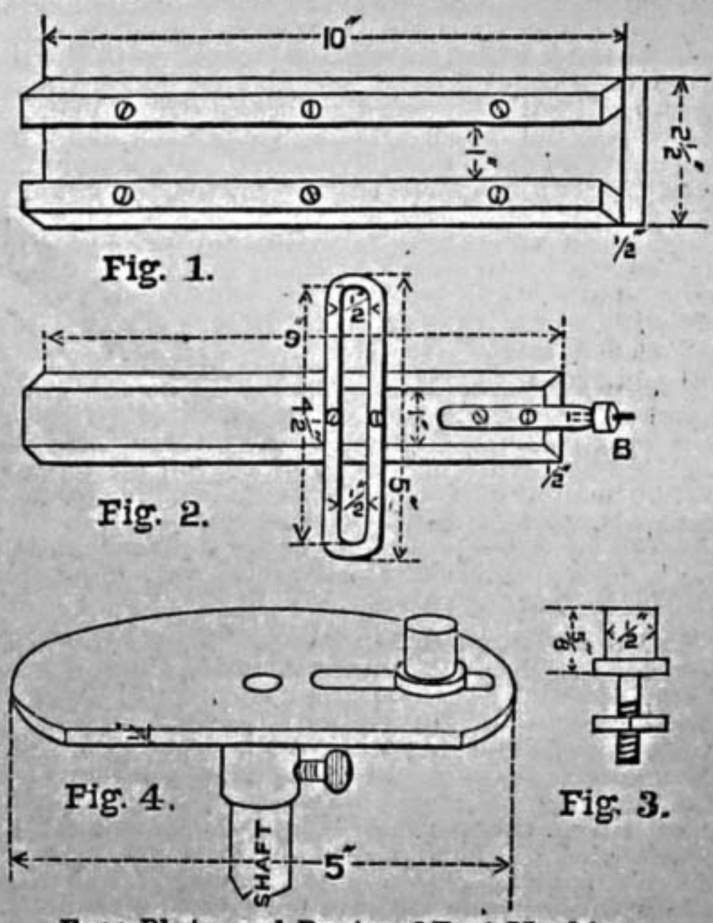
WORK Volumes.—J. H. S. (*Burnley*).—Volume I. of WORK is already published, and Volume II. will soon be ready. You can order these of any bookseller. The published price of each volume is 7s. 6d., bound in cloth.

Glass Letterings.—T. W. V. (*Leicester*).—I know of nothing that you can pour on glass to produce letters but hydrofluoric acid. Refer to my answer in No. 82, p. 487. This is the first method given, the one you refer to being the second. Cover with wax or Brunswick black, if you like that better, lay the glass level, building up a wall round the edges to prevent the acid running off, and pour hydrofluoric acid on. To give the letters a ground appearance, rub with glass-cutter's sand, and finish with emery.—W. E. D., JR.

Painting on Velvet.—J. C. (*Aberdeen*).—Light-coloured velvets are the best for painting upon, since the surface may be acted upon in the manner of dye colours without much detriment to the surface of the fabric. The velvet must first be tightly stretched upon a frame. Draw your design upon paper, prick through the outline, and transfer to your velvet with a pounce of very fine talc powder; tracing-paper may, of course, be used for both copying and pouncing if the design is a borrowed one. Now commence the painting by putting in the bright colours nearest the high lights of the painting; then paint in the shadows and blend the two into the half-tones. Use sable pencils for first outlining the design lightly, and then paint in with hog-hair fitches, preferably those well worn in. Work delicately and patiently from light to dark tones, remembering a little strength of colour can always be added, when it cannot be taken away so readily. Avoid flattening the pile, if possible, painting rather the sides of surface, and not "caking" it with colour. When it is necessary to use white either for high lights or for use upon dark velvets, take a little of the finest powdered gilder's whiting, or Paris white, and to this add powdered gum arabic in one part of the latter to four of white; use diluted with water. This white is then tinted upon with the pigments to the desired colour. The colours advised for this process are permanent liquid dye colours, thinned with water. The chief point is to dye or colour the pile without destroying its texture. When painting curtains or draped velvet, it is advisable to reproduce the pounce upon the back of the fabric, using a dry positive powder. We then paint the back texture of the velvet where all the strong and deep colours are, and these colours soaking through the back, but not touching the pile, very much enhance the effect of the painting when the light plays upon the folds of the velvet.—DECORATOR.

Staining.—FAUST, ETC.—As a "port-wine colour" is not a recognised tint to which mahogany is stained, I am unable to tell you how to get it. I should just experiment till I got it with various reds, and you should do the same. Of course you must take into consideration the colour of the unpolished wood. Good mahogany is generally considered rich enough when oiled and polished in the ordinary manner, and to stain it a "port-wine colour" would generally be regarded as spoiling the appearance. Mahogany naturally is not by any means the colour of port-wine. If you particularly want this, you might try a decoction of logwood, but I cannot say if it would give exactly the tint you desire. If you simply want a good deep rich mahogany colour, use weak walnut stain, and finish with red polish. If the wood is already very dark, omit the stain.—D. D.

Fret Machine.—F. T. C. (*Bristol*).—I have put down all you want to know. The face plate is cast iron, with a slot 2 in. in length, so that I can regulate the stroke of the saw to any pitch. I move the stud in the face plate of course. In my machine I have the stud 1½ in. from the centre of the face plate. This makes the cutting part of saw 3 in. in every stroke. You can use the saws that are short by moving the stud. You can make the wood slide



Face Plate and Parts of Fret Machine.

yourself without any wood turner. All you need will be four pieces of straight wood. Make one piece work smoothly in the other three. I append drawings.—G. C.

Small Electric Lights.—W. H. H. (*London, S.E.*).—The smallest electric lamps are those of 1

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c.p., taking a current of from ·3 to ·8 ampères at a pressure of from 3 to 8 volts. These cost about 5s. each, and can be obtained from Messrs. F. C. Allsop & Co., 165, Queen Victoria Street, E.C.; Messrs. Cathcart & Peto, 57B, Hatton Garden, E.C., or any other firm making a speciality of electric lighting apparatus. Six of such lamps, taking, say, from 5 to 6 volts each, placed in parallel series of two lamps in series, could be lighted by a small two- or three-celled chromic acid battery, or the current from a small accumulator of two or three cells.—G. E. B.

Re-Spoking Bicycle Wheel.—G. W. B. (*Lancaster*).—If G. W. B. wants to make a laced wheel, he will only require half the number of holes in the hub—namely, sixteen in each flange. The way to set about it is: put the hub in the lathe, hammer the flanges till they run true, and cut off the parts with the present holes, leaving the flanges as in Fig. 1. Bore sixteen holes through the thickness of each flange ¼ inch distant from the edge, as in Fig. 2. Round the holes a little on both sides, to prevent cutting the spokes. To build the wheel, find the proper length of the spokes by drawing the ring on the floor with the hub in the centre. Cut the wires long enough for two spokes and screw the ends, and see that the nipples will screw on with the fingers without difficulty, then double up the spokes exactly in the middle. Then

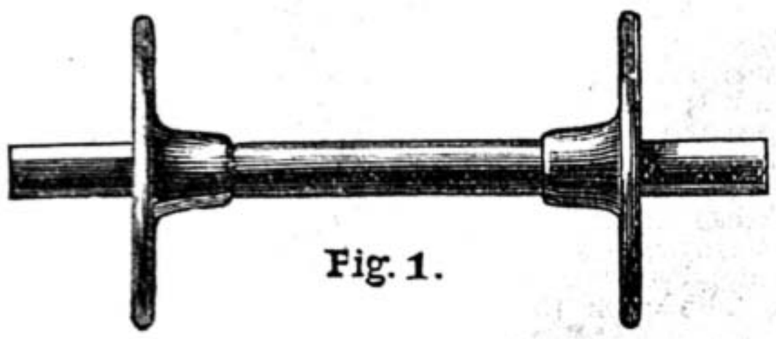

Fig. 1.

Fig. 2.

Fig. 3.

Re-Spoking Bicycle Wheel. Fig. 1.—Hub, with Flanges prepared for Laced Spokes. Fig. 2.—Hub Flange, showing Holes in Edge. Fig. 3.—Edge of Flange, showing lacing of Spoke.

lace through the flange, as in Fig. 3. Fix one end of the first spoke with a nipple in the rim, count twelve holes in the rim, and fix the other end. The second spoke will go through the next hole in the hub; at the rim it will miss one hole, and the other end of spoke will miss one also on the same side as the spoke first put in, and so on round the wheel on that side. The other side is treated in exactly the same manner. What is called a true laced wheel, with thirty-two spokes on each side, would miss about thirty holes, each wire thus running almost straight across the wheel, but laced wheels are mostly built by missing from eight to twelve holes. What remains is to true up the wheel by operating the nipples with a nipple key. Unless G. W. B. has some experience in wheel-building, this job will trouble him, as it is by no means as easily done as a direct spoke wheel. The spokes are usually tied with fine wire where they cross farthest from the hub flanges.—A. S. P.

Magic Picture.—S. R. (*Newry*).—I do not know the picture to which you refer, but can give you a hint or two on the subject. A picture may be made up by arranging strips of tin foil on a pane, as in the diamond and spotted Leyden jar. A transparency on a pane of glass may be also illuminated by a vacuum tube or two placed at the back. The outlines of these would only be visible whilst the spark is passing.—G. E. B.

Model of Electric Railway.—W. H. H. (*London, S.E.*).—You will find an illustrated description of the City and South London Electric Railway in the *Electrician* of November 7th, and more details of the same in the *Engineer* of the same date. The electric circuit is made between a flexible steel conductor run on glass insulators between the rails and the rails themselves, which take the place of a return wire. The current is picked up by "shoes," which slip along on the steel conductor, and then passes through the magnet coils to the frame of the locomotive and through the wheels to the rails. The reversing gear is on the locomotive. I do not clearly see how you can manage to work a model with three trains on it, so as to stop, reverse, and shunt them at will. The current from a battery can be arranged to work the trains, providing you have a large battery with large cells. Small cells holding, say, only one pint of solution, are useless for such work.—G. E. B.

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Electric Bell Circuit.—DENNY.—There can be no leakage from one wire to the other if one is insulated. Neither can there be any electrolytic action on either of the wires, and it matters but very little whether the upper or lower wire of the push is run to carbon or zinc of the battery. My opinion is quite in accord with Mr. Allsop's on such matters as these, but I have asked him to give you a word or two on the subject, and here it is:—"Provided the battery is properly insulated (and in what electric bell system is it not?) there can be no leakage. If the insulation of the battery is defective, there can, of course, be leakage from either pole, but in ninety-nine cases out of a hundred, the battery is placed in dry situations and on a dry wood shelf."—G. E. B.

V.—BRIEF ACKNOWLEDGMENTS.

Questions have been received from the following correspondents, and answers only await space in SHOP, upon which there is great pressure:—J. D. (*Glasgow*); AMATEUR ORGAN BUILDER; F. W. C. (*Amritsar, India*); D. E. E. (*Banchory*); APPRENTICE; TURNER; J. S. (*Halifax*); A. G. (*Hanley*); HOPEFUL; F. S. (*Normanton*); L. S. L. (*Kirkcaldy, N.B.*); H. M. (*Kent*); ELECTRIC; H. A. (*Birmingham*); R. H. H. (*Shutter Oak*); C. D. (*Bury*); R. H. (*Glasgow*); S. R. (*Newry*); A. E. S. (*Abingdon*); H. H. (*Cambridge*); W. B. (*Bridlington*); GISSIPIS; STAGE CARPENTER; A READER; J. R. (*Helmshore*); THISBE; PRINTER; C. W. S. (*Liverpool*); J. E. S. (*Finsbury Park*); COUPLER; C. W. B. (*London, W.C.*); A. G. S. (*Edinburgh*); C. J. G. C. (*Brighton*); A CONSTANT SUBSCRIBER; W. W. L. (*Wrexham*); SEQUAH; J. H. (*Bristol*); A. A. (*Coventry*); W. G. (*Erith*); F. R. B. (*London, E.*); W. P. & Co. (*Bristol*); J. W.; G. W. (*Blackburn*); H. M. (*Herts*); W. H. (*St. Helens*); J. C. (*Belfast*); H. B. C. (*Sunderland*).

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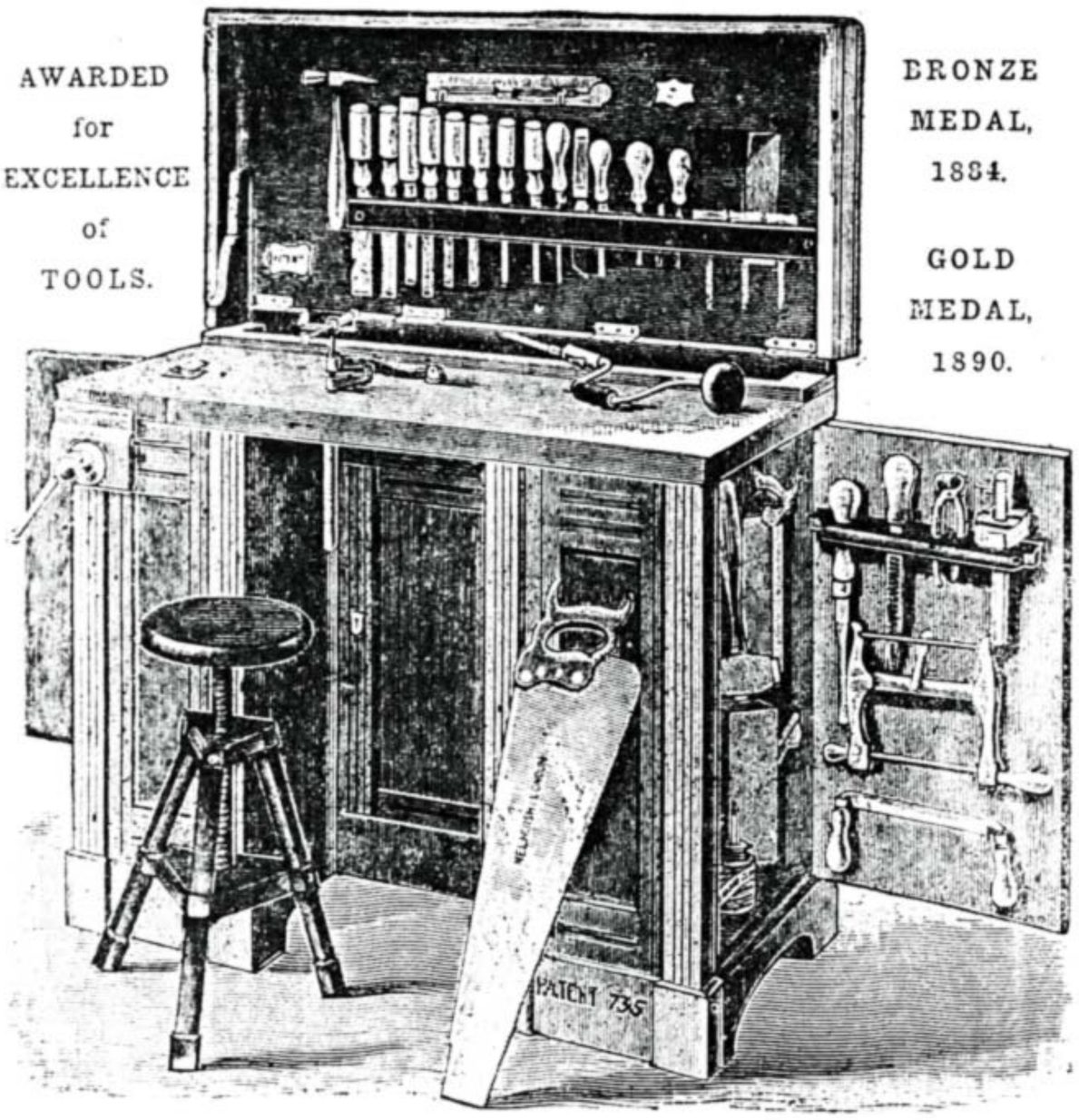

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